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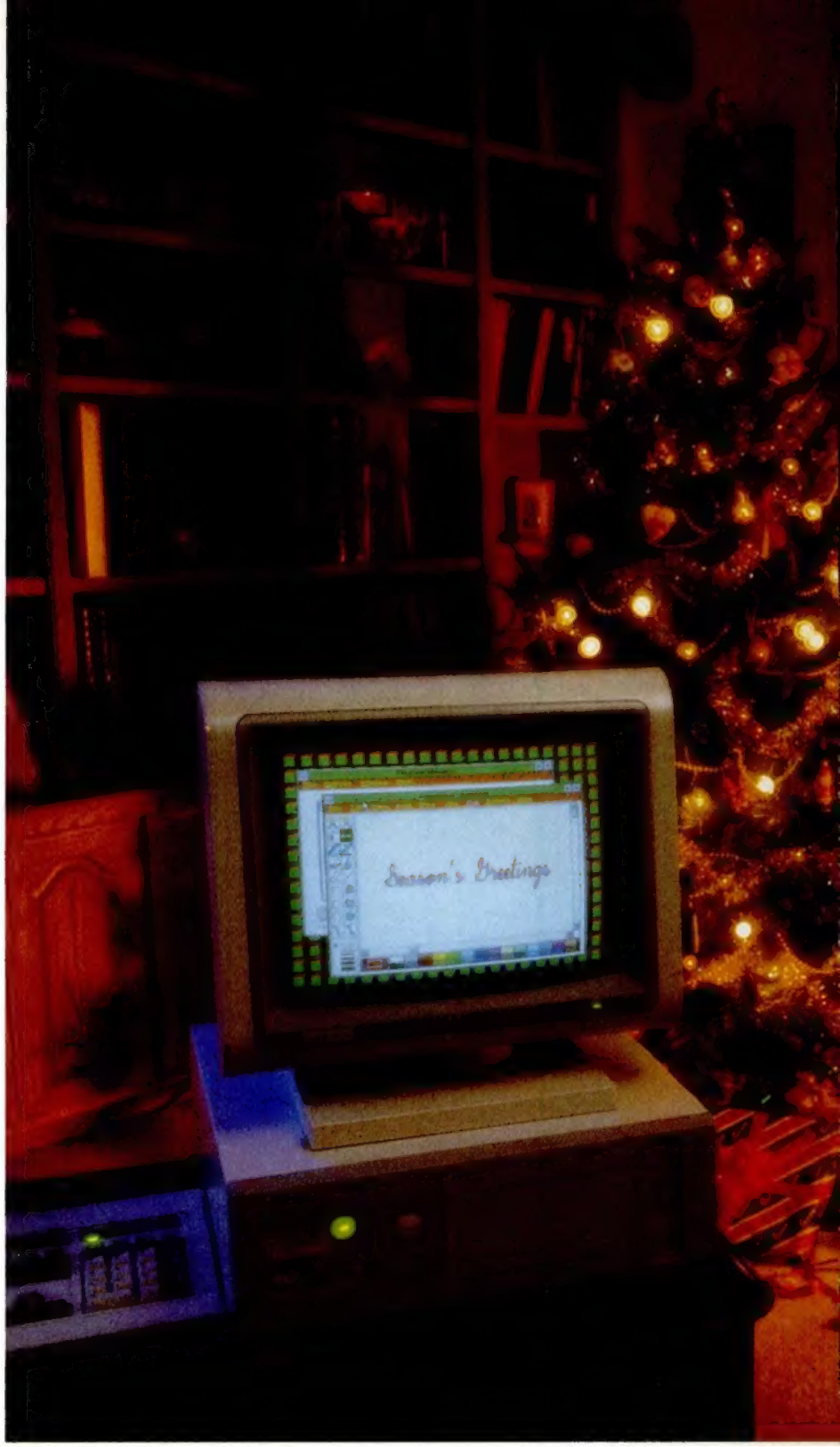

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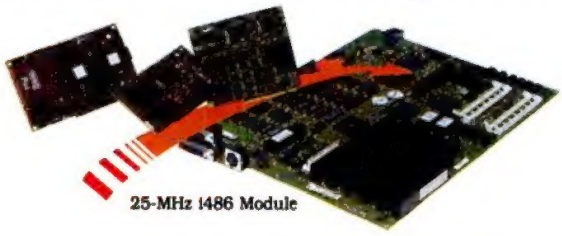

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CIRCLE 180 ON READER SERVICE CARD

Inside

1990 is coming to an end, and it's time for PC Labs to catch its collective breath. To paraphrase Winston Churchill, never before has so much hardware packed in so many foam-filled cardboard boxes been crammed into so few storage rooms.

A look back through this year's issues of *PC Magazine* shows that PC Labs benchmarked 285 or so PCs this year, including 83 portable PCs, 68 33-MHz 386 machines, 52 386SX systems, 39 20-MHz 386 machines, 24 486-based systems, and one IBM PS/1.

And that's just counting the big boxes. Don't forget the 131 printers, almost 60 monitors and video cards, 12 data projectors, and 10 desktop plotters.

When we add the dozens of products the PC LAN Labs staff evaluated in Florida and the hundreds of software packages we rounded up and reviewed, it's suddenly easy to understand all too well what the Census Bureau has been going through, and we empathize.

The person in charge of all this testing is newly appointed Director of PC Labs Jim Galley, a man whose interests extend far beyond computer technology.

Galley likes freedom in as many dimensions as possible. His hobbies, which include scuba diving and soaring, let him roam the seas and the skies. As PC Labs Director, Galley gets to cruise through the multidimensional interplay of new hardware and software products and the strategies behind them. The Labs' job is to reduce all the claims to clarity, and Galley brings us a unique background to lead that effort.

He joins us from a major New York financial institution, where a coworker said of him, "Sure, I enjoy seeing new stuff, but Jim *really* gets into it." His role there was to sort through the onslaught of new technologies in order to select the products that would give his company a competitive advantage.

Newly appointed PC Labs director Jim Galley is looking forward to a new year full of benchmark development.

In addition to being part of the original 386 evaluation team, his explorations have taken him into the worlds of virtual reality, neural networks, local- and wide-area connectivity, and virtually every phase of personal computers and their applications. As he looks forward to scrutinizing the countless products that come through PC Labs, Galley says, "This is a great opportunity to offer solutions not to just one company, but to everyone who reads *PC Magazine*."

All in all, 1991 looks like it will be the busiest year yet for Galley and his staff, but first they get a little break to contemplate the 12 days of Christmas. Let's just hope they don't bring their work home with them and end up testing a partridge in a pear tree.—**Donald P. Willmott** ■

PHOTOGRAPHY: THOM O'CONNOR

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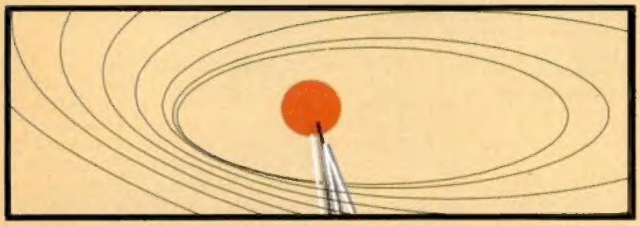

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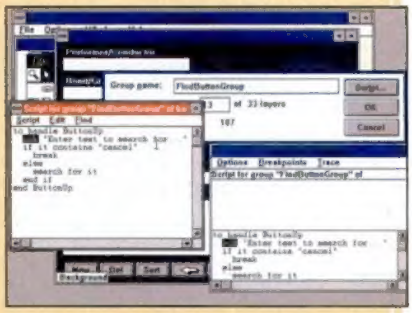

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HIGHLIGHTS

- 80C286 12MHz Microprocessor
- 6 lbs. Total Weight
- 1Mb RAM (expands to 3Mb on system board)
- 20Mb Hard Disk Drive
- 1.44Mb Floppy Disk Drive
- Pre-Loaded with MS-DOS 4.01
- Slim 2" Notebook Size
- Up to 4 Hours Operation Time
- Battery & Recharger Included

Complete 286/12 VGA System with 1Mb RAM, 20Mb Hard Drive, and Floppy Drive **$1890** Just $57 Mo.!

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HIGHLIGHTS

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- 2Mb RAM (expands to 4Mb on system board)
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- 1.44Mb Floppy Disk Drive
- Pre-Loaded with MS-DOS 4.01 Software
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- 82 Key Keyboard
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VIDEO DISPLAY

- Brilliant 10" VGA Diagonal Display with 640 X 480 Resolution

OPERATION FEATURES

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- Video/Audio Low-Battery Warning Indicator
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FCC Class B

HIGHLIGHTS

- 80386/DX Intel 25MHz Microprocessor
- 2Mb RAM (expands to 8Mb on system board)
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- Complete System for only $2890!

What would you say if we offered you a full-blown 386, VGA color system with 2Mb RAM, 125Mb hard drive with 32K cache, and GE on-site service for under $2900? That's what you want. And that's exactly what you get with an Austin 386/25!

AUSTIN 386/25 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387 Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Small Footprint Chassis
- Compatible with DOS, OS/2, and Unix

Complete VGA Color System with 125Mb Hard Drive, 2Mb RAM, and GE On-Site Service... **$2890** Just $87 Mo.!

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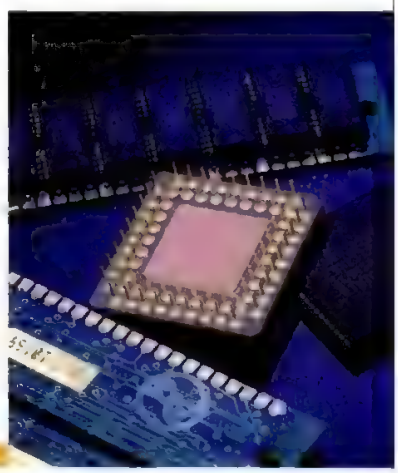
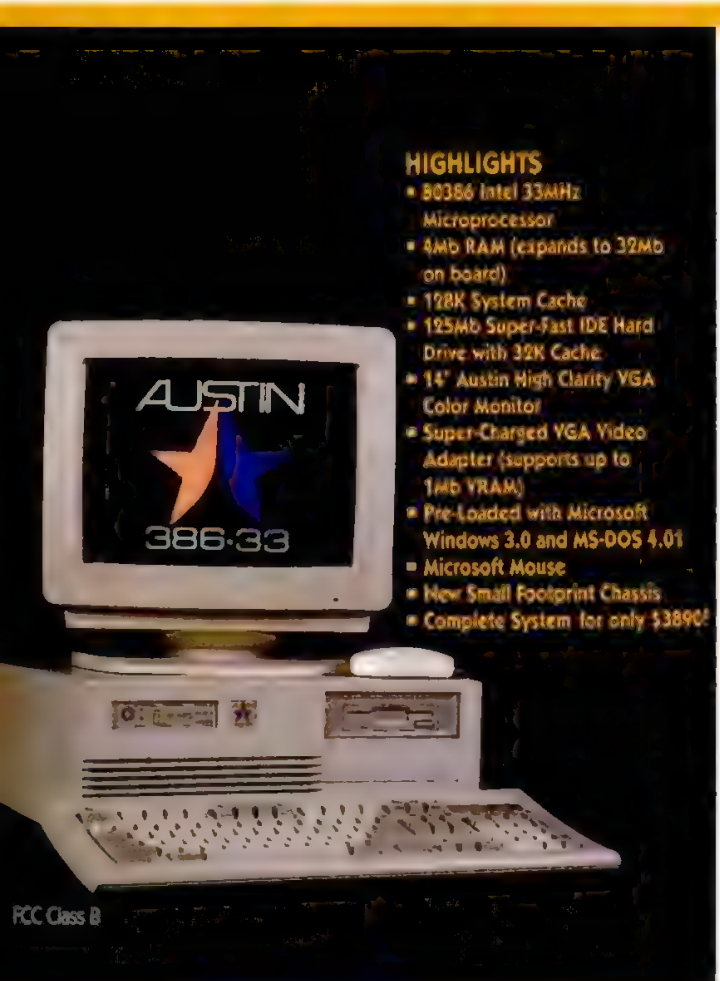




FCC Class B

HIGHLIGHTS

- 80386 Intel 33MHz Microprocessor
- 4Mb RAM (expands to 32Mb on board)
- 128K System Cache
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- New Small Footprint Chassis
- Complete System for only $3890!

AUSTIN 386/33 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Intel 80387 or Weitek 3167 Math Coprocessor Socket
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

Complete VGA Color System with 125Mb Hard Drive, 4Mb RAM, and GE On-Site Service... **$3890** Just $117 Mo.!

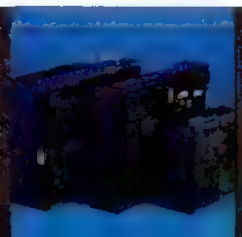
AUSTIN 386/33 PACKAGE OPTION

- Upgrade to an Ultra-Fast 175Mb Hard Drive and a Super VGA Color Monitor with 800 X 600 resolution...Plus 1Mb of Video RAM. $499
- Other options are available. Call for details!

Want to go incredibly fast? The Austin 386/33 will show you how fast *fast* can be. With its 4Mb RAM, 125Mb hard drive with 32K cache, and 128K system cache...you'll speed through everything. But don't just take our word. Deskdrive it!

All Austin 386's and the new 486/25e come fully loaded with the Microsoft Windows package. You'll get Windows-supporting features plus Microsoft Windows 3.0, DOS 4.01 and a Microsoft Mouse.

Austin's large selection of hard drives gives you what you need most...all the right options for storage capacity and seek time. We have IDE and ESDI, ranging from 40Mb to 1.2Gb.



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Power Up With Austin.

HIGHLIGHTS

- i486 Intel 25MHz Processor
- EISA Bus Architecture
- 4Mb RAM (expands to 64Mb on system board)
- Internal 8K Cache and Floating Point Unit
- Additional 64K External Cache (expands to 256K on system board)
- 125Mb Super-Fast Hard Drive with 32K Cache
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (supports 1Mb VRAM)
- Landmark v1.14 Rating-113.8MHz
- Complete System only $5990!

AUSTIN 486/25 WINSTATION

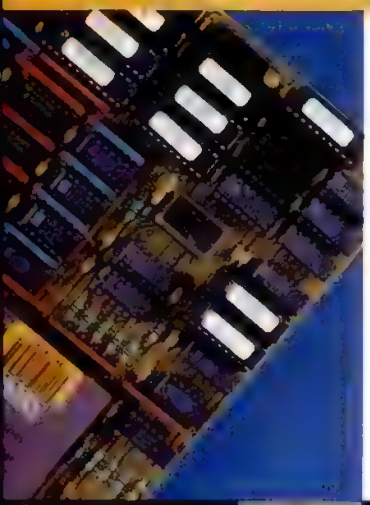
STANDARD FEATURES

- 8 32-bit EISA/ISA Compatible Slots
- 6 Slots available for Bus Masters
- 4167 Weitek Math Coprocessor Support
- Shadow RAM Caching (BIOS/Video)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Floppy Drive (1.44Mb or 1.2Mb)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- RealTime Clock with Battery Backup
- Microsoft Windows 3.0 and MS-DOS
- Microsoft Mouse
- Fully Novell, DOS, OS/2, and Unix Compatible
- EMS LIMM 4.0 Support

Complete VGA Color System with 125Mb Hard Drive, 4Mb RAM, GE On-Site Service. . . **$5990** Just $180 Mo.!

AUSTIN 486/25 PACKAGE OPTION

- Upgrade to an Ultra-Fast 175Mb Hard Drive and a Super VGA Color Monitor with 800 X 600 resolution. . . Plus 1Mb of Video RAM. $499



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HIGHLIGHTS

- 80286 16MHz Microprocessor
- 1Mb RAM (expands to 8Mb on system board)
- 40Mb IDE Hard Disk Drive
- Floppy Drive (1.44Mb or 1.2Mb)
- VGA Monochrome Monitor with VGA Video Adapter
- Complete System for only $1290.

FCC Class B

Why pay over $400 more for an IBM PS/1 and get less? The Austin 286/16 has more memory, more expansion, more features, and GE on-site service included...for only $1290! And if this isn't enough, the Austin 286/16 is also 30% faster!

AUSTIN 286/16

STANDARD FEATURES

- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 1 Parallel Port and 2 Serial Ports
- 80287 Math Coprocessor Socket
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Built-in Setup Program
- Compatible with DOS and OS/2
- American-Made Motherboard

Complete VGA System with 1Mb RAM, 40Mb Hard Drive, and GE On-Site Service... **$1290** Just $39 Mo.!

AUSTIN 286/16 SPECIAL PACKAGE OPTIONS

- Upgrade to VGA Color Monitor $249
- Upgrade to 2400 Baud Modem $149
- Microsoft Windows Package—Windows 3.0 and MS-DOS 4.01 Pre-Loaded...Plus a Microsoft Mouse $179

Our Editor's Choice just got better! Now you get all the award-winning features...plus the new Microsoft Windows 3.0, MS-DOS 4.01, and even a Microsoft Mouse. Go with a real winner...the Austin 386/SX16!

HIGHLIGHTS

- 80386SX Intel 16MHz Microprocessor
- 2Mb RAM (expands to 8Mb on board)
- 40Mb IDE Hard Drive
- 14" Austin High Clarity VGA Color Monitor
- Super-Charged VGA Video Adapter (Supports up to 1Mb VRAM)
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- Complete System for only $2190

FCC Class B

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AUSTIN 386/SX16 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

Complete VGA Color System with 2Mb RAM, 40Mb Hard Drive, and GE On-Site Service... **$2190** Just $66 Mo.!

AUSTIN 386/SX16 PACKAGE OPTION

- Upgrade to Fast 85Mb Hard Drive with 32K Cache for speeds of less than 18ms and a Super VGA Color Monitor with 800 X 600 resolution...Plus 1Mb of Video RAM. $299
- Other options are available. Call for details!

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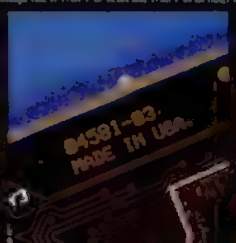

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Announcing our new Austin 386/SX20! All the right features...right on the price. You get the new Intel 80386SX 20MHz processor, 2Mb RAM, 85Mb hard drive, Microsoft Windows, and more. It's fast. And it's loaded!

AUSTIN 386/SX20 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

Complete VGA Color System with 2Mb RAM, 85Mb Hard Drive, and GE On-Site Service... **$2490** Just $75 Mo.!

AUSTIN 386/SX20 PACKAGE OPTION

- Upgrade to Super-Fast 125Mb Hard Drive with 32K Cache and a Super VGA Color Monitor with 800 X 600 resolution... Plus 1Mb of Video RAM. $399
- Other options are available. Call for details!

FCC Class B

In *PC Magazine's* 386/SX-20 Editor's Choice review, they said, "The Austin 386/SX-20 PowerStation narrowly missed this award (Editor's Choice) because the FCC had not yet granted it Class B status..." Well, guess what! We've got it now!

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Letters

WHERE IS SUPPORT HEADED?

I have a few comments regarding Jim Seymour's column "900-Numbers: Where Support Is Headed?" (September 25, 1990).

Toll-free, 800-number support *best* not be dead. Where I work, every long-distance toll call is accounted for, and the funding for long-distance phone calls comes out of my department's budget. It *is my* money, and I *do* care what I have to pay for a support call.

If a program's documentation were adequate, that would be one thing. Most manuals barely tell you how to install the software, so users must now call the 900-number support line for answers that should have been in the manual in the first place. This creates a large volume of callers, and so people often end up on hold for extended periods *with the meter running*.

If I don't like the documentation or the support practices for a product, I cannot recommend it.

Bernard J. Siegel
Universal City, Texas

In his September 25 column, Jim Seymour says that we are going to have to start paying for technical support. He seems to think this is justified and appropriate.

Good software technical support is really a warranty. When someone buys a product, they expect to be able to use it. I think any producer has an ethical obligation to fulfill this most basic customer expectation.

Just imagine going back to your car dealer. You think your transmission isn't shifting properly. The service manager says, "Okay, give me $200 and we'll talk about it." If the automobile industry adopted this "pay me before I'll talk to you" service policy, I think the homicide rate would double.

Free technical support can also be used for the company's advantage, too. It's a very valuable source of feedback.

Tim Hickox
Cerritos, California

Jim Seymour

900-Numbers: Where Support Is Headed?

Our readers speak out strongly against paying for support.

I read Jim Seymour's column on support with growing dismay. Sure, I'm happy to pay for support if I'm too dumb to figure it out and it's in the manual. But, for example, what happens when my unit needs repairs? The supplier wants me to pay for a call (on a 900 number, yet) to get an RMA number so that I can pay the shipping to send the unit, which they will keep for an unknown length of time. At least let me call at regular long-distance rates! Many companies routinely block 900 and 976 calls.

Service is a complicated issue, but charging for calls is not going to make a company any friends.

J. P. Harrison
Hood River, Oregon

THE 386SX: TOO POPULAR?

I recently read your article "The Cheapest 386SXs Ever" (August 1990). I was impressed with your Editor's Choice: the Micro Express ME 386SX, so I called the company and placed an order. From there it has been downhill, and I finally canceled my order today.

The 800 number is always busy, and later I called the regular number, but no one returned my calls. I feel you owe it to your readers to advise them that a 15-month warranty means nothing when you can't get through to the company.

Jim DeProspero
Lake Oswego, Oregon

In July I placed an order for your "Editor's Choice" 386SX, the Micro Express ("The Cheapest 386SXs Ever," August 1990). The computer did not arrive when promised, and when I called the company's customer service department, I was told that they would look into the matter and call me back that day. I never received a call. My follow-up calls failed to elicit a response. Reluctantly, I canceled my order.

Just got my VISA bill, and guess what? I had been charged for the computer I had canceled and never received.

Jean Kreiling
Brooklyn, New York

A representative for Micro Express responds:

As a result of your article, sales at Micro Express have tripled; the company has already shipped thousands of those machines (the ME 386SX) at the price quoted in the article.

Unfortunately, Micro Express has been caught by the shortage of 386SX chips from Intel. Due to this chip shortage, Micro Express is forced to quote lead times of about 12 weeks, when they normally ship in five days. In fact, they have started a waiting list for new callers who insist on that machine.

The calls have been coming in so hot and heavy that Micro Express has installed a new phone system, with several more lines. They have doubled the manufacturing staff, added new tech support people, and new salespeople. The machine is *absolutely* for sale at the price in the article for anyone who can wait.

David Kaye
President, KPR Inc.
Public Relations for Micro Express

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CIRCLE 745 ON READER SERVICE CARD

Letters

PC MAGAZINE We've heard from many companies that there is a severe shortage of 386SX chips out there. Readers, please be patient!—*Ed.*

KEEP BOOKS THE WAY THEY BELONG

I'm responding to the letters about the Encyclopaedia Britannica ("CD-ROM vs. Books," Letters, September 25, 1990). I own the complete set of Britannica 3, bound in leather. The books are impressive, and I, my wife, and our home-schooled son use them frequently.

The books were one of the first things I purchased when I bought my first house. I have subsequently changed both houses and bookshelves; however, I still have the books.

I'm an engineer and former programmer, and I have owned computers. I like computers and use them for what they are good at; I would not want the encyclopedias on disk or CD-ROM. Please thank Stan D. Frank for his thoughtful response.

Adrian J. Cramer
Claremont, California

LET THE DONOR BEWARE

I applaud Bill Machrone's recommendation to give used computers away to schools, churches, and other organizations in his October 16, 1990, column, "Upgrading the Installed Base." Many schools and churches *desperately* need computers.

I must point out, however, that in many cases where the computer has been used in a business, the donor's basis is zero, yielding *no* tax deduction for the gift. This is because they have either owned it long enough to have written it off completely or had already taken advantage of some special provisions in the tax code that allowed them to write off the entire amount of the computer the year it was purchased.

In either case, since they have already written off the cost of the computer once, they will not get to write it off again when they give it away. Writing off the same thing twice is *definitely* not allowed.

Jay Norris
Topeka, Kansas

PC MAGAZINE He's right. You cannot always get a tax deduction when you donate a computer to a charitable organization. There are, however, exceptions to every rule. Please consult a tax advisor before making any tax decisions.—*Ed.*

LIFETIME WARRANTIES

In regard to a letter about lifetime warranties, from Jeremy B. Clark (Letters, September 25, 1990), I purchased two boxes of ten BASF 3.5-inch 2HD disks.

> Lunds donated an Apple computer for every $100,000 in receipts collected. It gave 342 computers to 160 schools.

One disk in each box had bad sectors. I mailed both disks to BASF with a print screen of the formatting results.

Less than two weeks later I received a letter of apology and *six* new disks! Needless to say, I am a BASF customer for life.

Teresa Van Wagner
Sparr, Florida

WHY JOHNNY CAN'T COMPUTE

Yesterday I read Bill Machrone's column "Why Johnny Can't Compute," (September 25, 1990) in which he bemoans that business isn't doing its part to help today's students become computer literate. Machrone specifically referred to a grocery chain that donated one Apple IIC to any customer who saved $300,000 in register receipts. He asserted that while the program was a "nice" gesture, it was something of an exercise in futility.

Today I read an article in the *Minneapolis Star Tribune* telling how Lunds, a Minneapolis-based grocery chain, has run a similar program, where an Apple computer is donated for every $100,000 in receipts collected. In this past year, this has resulted in 342 computers given to 160 schools. Lunds spent over half a million dollars on the giveaway. Not bad!

Marty Proops
Hopkins, Minnesota

In Bill Machrone's September 25 column he states, "The first challenge is to get

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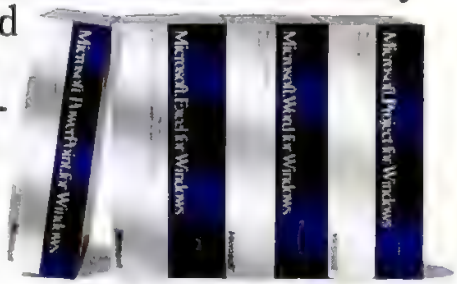

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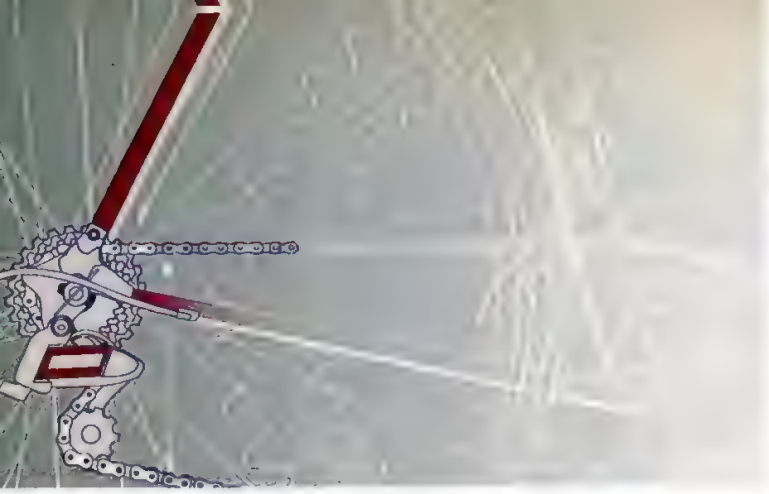

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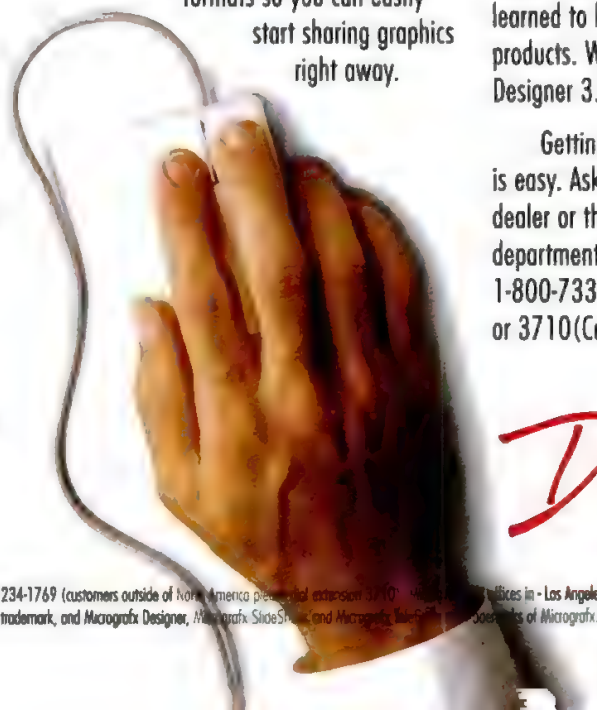

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computers, real computers, into the classroom."

Although mine might be an unpopular point of view, I firmly believe that the choice of device to install in our schools is irrelevant; it's the application of that device that matters.

> It's not the machine that's important in teaching computer literacy, it's the teaching technique that matters.

Teachers should stress that computers are not an end in themselves; they are a means to an end. Students should be taught how to program properly and *not* to be dependent on prepackaged software.

The computer is a tool with which the student can get something done. Teachers should emphasize this point by integrating computer solutions into their existing science and math curricula, rather than teaching computer science only as a discrete subject.

It's not the machine that's important in teaching computer literacy, it's the teaching technique that matters. Johnny's poorly written program will fail just as miserably on a 32K RAM machine as on a 1MB RAM machine.

Roger Claff
New York, New York

WE NEED MORE!

Jim Seymour's cover story ("The First 24 486/25 PCs: Giant Step or Stepping Stone?" September 11, 1990) refers to a legend that Samuel Gompers had once said the job of labor leaders is "on every occasion to shout 'More!!!' "

Here is what Gompers, president of the American Federation of Labor (AFL) from 1886 to 1924, actually said:

"What does labor want? We want more schoolhouses and fewer jails, more books and fewer arsenals, more learning and less vice, more constant work and less crime, more leisure and less greed, more justice and less revenge."

Richard Khamsi
Eureka, California

BACKSOLVER BACKLASH

Craig Stinson's review of *Lotus 1-2-3/G* ("*1-2-3/G:* The Super Solver," August 1990) states that the current version of *Backsolver* "does not include a command to restrict adjustable cell values to whole numbers, so for many real-world problems, you will need to round off the result."

As I recall, one of the basic tenets of Integer Linear Programming is that an LP solution confined to integers can be wildly different than one that is not so constrained. If your readers run *Backsolver,* get a noninteger solution, then round it off as Mr. Stinson suggests, they could be off by many orders of magnitude.

That's not very significant unless your job, your company, or your life rides on the results of the analysis.

Woody Leonhard
Coal Creek Canyon, Colorado

PC MAGAZINE A spokesman for Lotus denied that using noninteger methods could produce wildly erroneous results, off by orders of magnitude. If integer solutions are required, however, you can use @INT to constrain the variable cells.—*Craig Stinson*

CORRECTIONS & AMPLIFICATIONS

Michael J. Mefford has been flooded with requests for DirMagic updates as offered in Letters, September 25, 1990. He will gladly continue to send DirMagic to anyone, but asks that all requests include $15 for shipping and handling. Send them to Michael J. Mefford, P.O. Box 351, Gleneden Beach, OR 97388.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, complaints, insights, and suggestions. Please send them to Letters, *PC Magazine,* One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access information). All letters become the property of *PC Magazine* and are subject to editing. Please address mail to *PC Magazine,* with the department printed on the envelope so that we can quickly direct your letter. ■

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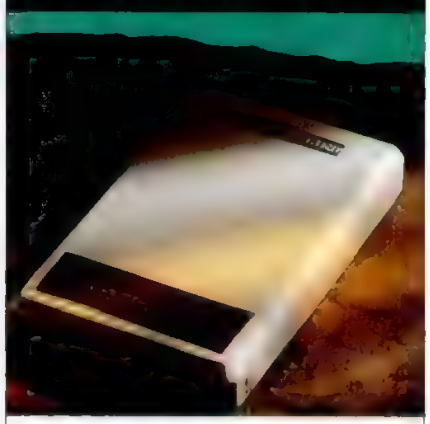

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Fact is, at $799, the 9600EX rivals the price of high-end 2400 modems. Yet, it offers 16 times the performance. Or in other words, more modem for the money.

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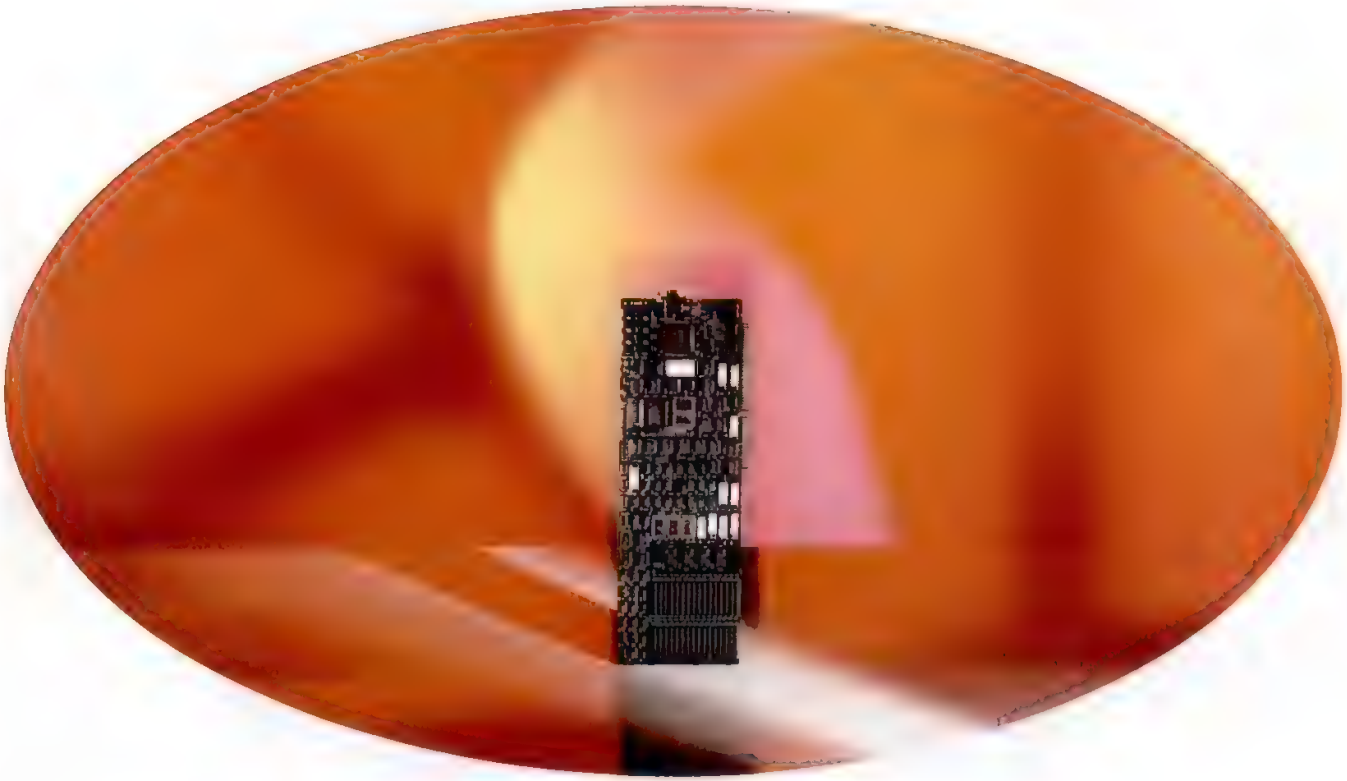

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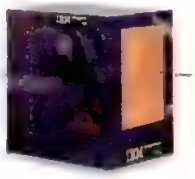

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CIRCLE 741 ON READER SERVICE CARD

by
Gus Venditto

Advisor

CALCULATOR-EQUIPPED KEYBOARDS

I am trying to find a company that manufactures and distributes a keyboard with a calculator built into the right side. Can you help?

Gary Nusca
Hamilton, Ontario
Canada

MicroLab in Farmington Hill, Michigan, has a full line of PCs with calculator-equipped keyboards, and sells them for $79. The calculator is battery-powered and operates separately from the PC keys, so there are no compatibility problems (it also means there's no way to paste the calculator results into a document).

The Focus 5001 keyboard also has an extra set of function keys (one across the top and another in two columns along the left side). It's designed to be used as a replacement for standard AT-style keyboards and may work on computers with other keyboards, though you should check with MicroLab (313-474-7711) before ordering if you're planning to replace anything other than an IBM keyboard.

The company also offers the keyboard as an option on its line of 386 and 386SX PCs.

ADDING MEMORY TO A LAPTOP

I own an NEC PowerMate SX Plus which came standard with 2MB of RAM. However, now that I'm using *Windows* 3.0, I would like to add another 2MB. Apparently, NEC has configured this system in such a way that any memory expansion can only be achieved by purchasing an NEC expansion board for about $1,800 for 2MB. This is an unfair amount to pay for such a standard upgrade, especially since the laptop itself was little more than $2,000.

Is it possible to install additional RAM in any other way?

Scott Stallings
Rancho Cucamonga, California

- CALCULATOR-EQUIPPED KEYBOARDS: A hardware solution.
- ADDING MEMORY TO A LAPTOP: Where to get a better price on RAM.
- THE SEARCH FOR THE ELUSIVE LAPTOP CURSOR: Software that enlarges the cursor.
- SWITCHING CONFIG.SYS AT BOOT TIME: How to manage multiple setup configurations.
- A SCREEN BLANKER FOR WINDOWS 3.0: Software that password-protects your display.

There's always another way—though your choices are usually more restricted with laptops.

Laptop designs are so intricate that an owner can make very few upgrades; fortunately, memory is an exception.

First Source International sells memory upgrades for a wide variety of laptops, including your NEC PowerMate.

Memory prices change as frequently as the weather, but these were the stated quotes in late September: A 1- to 2MB upgrade kit cost $375 with 1MB onboard; the second MB kit costs an additional $292.

A 4- to 8MB board cost $992 with 4MB already in place; a kit that adds 4MB more costs $875.

First Source International is located in Aliso Viega, Calif.; you can reach the company at 800-535-5892.

THE SEARCH FOR THE ELUSIVE LAPTOP CURSOR

I find that the cursor on my Compaq LTE 286 is nearly invisible when I use *WordPerfect* 5.0. Is there a patch or some alternative that will convert the blinking line cursor to a blinking or solid box that will be more readily seen?

Roy W. Menninger
Topeka, Kansas

There are a couple of inexpensive programs that can take the strain out of editing on a laptop.

Both *No-Squint II Cursor Enhancer* (SkiSoft Publishing, Lexington, Mass.; 800-662-3622; $49.95) and *EZC Smart Cursor* (Triple S Software, Corona, Calif.; 714-278-3780; $37.95) will let you make the cursor larger and have a variety of options for the shape that the cursor takes.

SWITCHING CONFIG.SYS AT BOOT TIME

I read a while back about a program that allowed setting configuration information at boot time. I remember thinking that it was an interesting program, but one for which I would never have a use. I should never say "never."

I now have a number of different CONFIG.XXX and AUTOEXEC.XXX files that I select via a .BAT file and then reboot my system to make the change. I would very much like to specify my configuration at boot time.

Rev. Lloyd Landers, Jr.
Bartlesville, Oklahoma

The program you're thinking of was written by *PC Magazine*'s assembly language ace Michael Mefford and was published in the November 29, 1988, issue.

Unlike most of the utilities we publish, CONFIG.CTL is a device driver that you install in your CONFIG.SYS file. CONFIG.CTL will pop up a menu at boot time that lets you choose all of the

configuration options you care to set.

It won't affect your AUTOEXEC.BAT file, though. DOS's batch language provides all the statements you'd need to write an AUTOEXEC.BAT file that will let you choose options before the boot procedure executes them. With the batch file commands ERRORLEVEL and PAUSE you'd be able to write an AUTOEXEC.BAT file that lets you choose your setup.

If you don't feel up to writing such an AUTOEXEC.BAT file, you may want to use the batch file one of our readers submitted to the User-to-User column for the August 1990 issue.

This batch file, RECONFIG.BAT, lets you choose among several CONFIG.SYS and AUTOEXEC.BAT files; it will then reboot the system automatically, putting the changes into effect immediately.

You can download CONFIG.CTL or the August User-to-User column from PC MagNet. See page 8 of this issue for subscription information.

A SCREEN BLANKER FOR WINDOWS 3.0

Before I acquired *Windows* 3.0, I used *AutoMenu* from Magee Enterprises to organize and access my programs. It also had a screen-saver feature that would blank the screen after a certain time had passed.

> The *hDC First Apps* screen saver lets you install a password that will be required before the original display returns.

Can you suggest a vendor that has such a program?

John Hafey
Cleveland, Ohio

There are screen savers in two of the *Windows* utility toolkits sold by hDC in Redmond, Wash. (206-885-5550).

In *hDC Windows Express*, you get a screen saver that will blank the screen if there's no activity for a minute.

In *hDC First Apps*, you get a more sophisticated screen saver. You have a choice of whether the monitor is completely blanked or whether a full-screen graphic takes over. You can choose from several colorful graphics, including some that are animated, or you can use a graphic of your choice, so it's possible to display the company logo or even your own portrait, if it's in BMP format.

Also, the *hDC First Apps* screen saver lets you set the period of inactivity and lets you install a password that will be required before the display returns.

ASK THE ADVISOR

Send your questions to PC Advisor, One Park Avenue, New York, NY 10016 or upload them to PC MagNet (see the instructions for joining on page 8 of this issue). Sorry, but personal replies are not possible. ■

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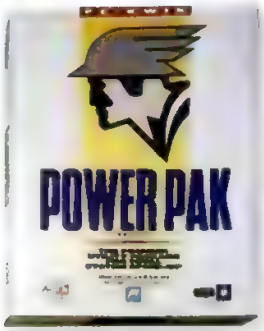

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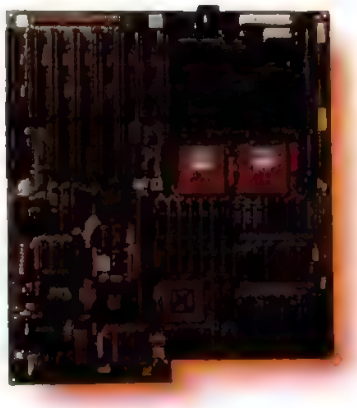

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First Looks

Hands-On Reviews of the Latest Products

Compaq's LTE 386s/20: Performance Worth the Price

HANDS ON by Matt Jones

It ain't cheap or exactly perfect, but if you need desktop power and expandability in a notebook portable, the Compaq LTE 386s/20 is a difficult machine to pass up. Its most obvious assets are its 20-MHz processor and 4K static-RAM cache, generous 10MB RAM capacity, 30MB standard-equipment hard disk and optional 60MB model, 9-inch, black-and-white VGA display, and its ability to accommodate a 20-MHz 80387 math coprocessor. As with earlier LTE models, the 386s/20 provides battery-powered operation in excess of three hours, makes room for an optional internal modem, and comes with plenty of I/O connectors and a 3.5-inch, 1.44MB floppy drive.

Need a little more convincing before you pay the $6,499 base configuration list price? As with most Compaq machines, the LTE 386s/20's strengths lie as much with its sturdy feel, the polish and breadth of its documentation and utilities, and its wide range of options as with its brute-force power and performance.

The LTE 386s/20 uses the same general form factor and styling as the LTE and LTE/286, measuring 11 inches wide by 8.5 inches deep. This latest model measures 0.35 inches thicker than previous LTE models (2.25 inches), and adds a few unwelcome ounces as well. The base configuration machine weighs 7.5 pounds. Our evaluation unit, which included an 80387SX math coprocessor, a third megabyte of RAM, and the internal 2,400-bps modem, weighed 7.75 pounds, about half a pound heavier than a similarly equipped LTE/286.

To keep battery life above three hours in this more-powerful LTE, the removable nickel cadmium battery pack was beefed up by 0.2 pounds, to 1.7. Our evaluation unit ran for 3 hours and 8 minutes on the PC Labs battery rundown test with all battery conservation features disabled. The LTE 386s supports automatic component shutdown, system shutdown, and hard disk spin down. The power brick, which weighs 1.4 pounds with cables attached, recharges the battery in 1.5 hours when the machine is off and 3 hours when it is in use.

The display accounts for the increased chassis thickness as well as some of the weight gain, but you won't mind. Developed by Citizen, the edge-lit display measures nearly 40 percent larger than the CGA versions of previous LTE models. It employs film-compensated supertwist LCD technology, the same technology used in the excellent display of the Sharp PC-6220. Both displays offer 640-by-480 resolution and 16-shade graphics. Side-by-side comparison revealed differences but no certain winner: The Compaq was notably brighter while the Sharp seemed slightly crisper and more homogeneous.

The machine includes an external VGA monitor port which can be toggled as the active display through use of a Ctrl-Alt key combination. Other stand-

CONTINUES ON PAGE 34

Compaq's 7.5-pound 386SX. The connection to the expansion base (inset) lies behind a sliding panel.

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R:BASE 3.1
Faster, manages memory better, and does *dBASE*, too 36

Macro Editor/Debugger
Finally debug your *1-2-3* macros 46

NCR 6436-0301 SCSI Printer
Races through graphics print jobs 48

Turbo Vision Debuts in Turbo Pascal 6.0

HANDS ON by Neil J. Rubenking

Since the introduction of Turbo Pascal in 1983, Borland has come out with a new and improved compiler almost every year. The previous upgrade brought object-oriented programming to Pascal. Now, the $149.95 Turbo Pascal 6.0 (TP6) gives us "event-driven" programming in a complete application framework. This version is a far cry from the one-disk original—its elegant Install program puts three megabytes of files on your disk.

The compiler itself hasn't changed much; all but a very few existing programs will compile under the new version. The big news is that the IDE (Integrated Development Environment) is now fully mouse-aware, with multiple movable resizable windows and an inter-window cut-and-paste feature. Also BASM, the new built-in assembler, eliminates the drudgery of counting bytes for INLINE code, and the built-in debugger now has features that were previously found only in the standalone Turbo Debugger. The built-in Debugger's new features are specifically designed for debugging event-driven programs.

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Compaq LTE

CONTINUED FROM PAGE 33

ard equipment connectors include a 9-pin serial port, a 25-pin parallel port, and a PS/2-style mouse port. All ports reside behind a sturdy sliding panel. The optional 2,400-bps internal modem supports V.42bis, MNP 5 error correction and data compression protocols, and provides dual jacks.

The LTE 386s system board comes standard with 2MB of 80-nanosecond RAM, along with the 4K four-way associative static RAM cache. A small compartment at the left side of the machine allows quick installation of as many as two credit card-sized RAM cards. These provide either 1MB or 4MB of 80-ns DRAM for $549 and $2,199 respectively. Contrary to preintroduction rumors, these 60-pin cards provide dynamic RAM, not the nonvolatile storage of Intel's 68-pin, Flash EEPROM cards. Compaq reports that this 60-pin design is its proposed standard for laptop DRAM expansion cards.

There's also plenty of hard disk capacity—a 2.5-inch, 30MB hard disk or, for an additional $500, a 60MB version. Both of these Conner Peripherals disks carry a rated average random access time of under 19 milliseconds.

Aside from its substantial weight, our only notable complaint with this machine is its keyboard. The key mechanism is firm, but the keyboard layout renders the cursor control keys nearly unusable. As with their other laptops, Compaq arranged these four keys in a lazy L formation, with the Up arrow key above the Down arrow key to the far right.

All in all, it's difficult to see the Compaq LTE 386s/20 as anything but an excellent machine, despite its heft and aggravating keyboard layout. If all you need is a hard-disk-packing notebook portable, you may be better off with a lighter, thinner, less-expensive machine. But if you need the combination of power, performance, battery life, and expandability, the LTE 386s/20 is your best choice. ■

BENCHMARK TESTS: COMPAQ LTE 386s/20

PC LABS

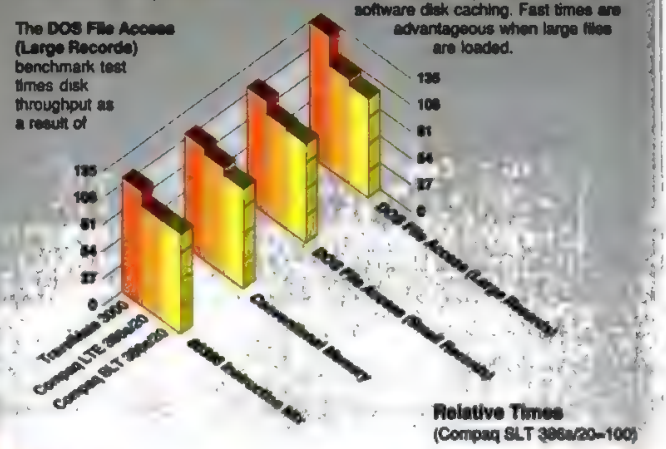
Compaq's new 386SX notebook, the LTE 386s/20, outperforms Texas Instruments' TravelMate 3000 on all our tests, and offers similar performance to its sibling, the powerful Compaq SLT 386s/20.

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



Performance Times (Times given in seconds)	80386 Instruction Mix	Conventional Memory	DOS File Access (Small Records)	DOS File Access (Large Records)
TravelMate 3000	3.57	0.41	66.14	7.34
Compaq LTE 386s/20	3.11	0.44	61.13	5.90
Compaq SLT 386s/20	3.11	0.41	59.74	5.58

FACT FILE

PC MAGAZINE

Compaq LTE 386s/20
Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; (800) 231-0900, (713) 370-0670.
List Price: With 2MB RAM, 4K static RAM cache, 30MB hard disk, 1.44MB 3.5-inch floppy disk drive, film-compensated supertwist LCD VGA, one serial port, one parallel port, one mouse port, battery pack, AC adapter, utilities, $6,499; with 60MB hard disk, $6,999; with 3MB RAM, 30MB hard disk, enhanced 2,400-bps modem, 80387SX math coprocessor, $8,646; additional nickel cadmium battery pack, $169; carrying case, $89; automobile adapter, $129; desktop expansion base, $1,499; DOS 3.31, $120; other options available.
In Short: A sturdy 386SX-based notebook portable that offers nearly everything a confirmed power user could ask for. The major drawbacks include the machine's 7.5-pound weight and its awkward arrangement of the cursor-control keys.

CIRCLE 648 ON READER SERVICE CARD

COMPAQ'S TRENDSETTING DOCKING STATION

Unlike various vendors' past attempts, Compaq's $1,499 Desktop Expansion Base station looks like a small-footprint desktop PC, not like a Trekkie's misguided fantasy. The one obvious difference between this cabinet and a desktop PC is the opening near the top of the front panel of the machine, the bay for the LTE 386s/20.

To insert the LTE 386s/20 into its base, you simply slide the LTE's back-panel connector cover to the open position, slide the closed laptop into its bay, and push the laptop firmly into place. Guides on each side of the bay make the process foolproof; the single pair of connectors is well designed and sturdy.

The expansion base contains no processor, memory, or controllers. The laptop supplies all major internal components, including the hard disk. The base unit provides a 145-watt power supply, two 16-bit expansion slots, internal bays for a 1/3-height floppy drive and half-height tape drive, and standard connectors for a desktop VGA monitor, keyboard, mouse, printer, and external serial device. The base automatically quick-charges the laptop's internal battery as you work.

Our one complaint with the otherwise thoughtfully designed expansion base concerns its lack of phone-jack connections. The expansion base documentation advises you to connect your office phone cables to the laptop's internal modem. While this is easy enough to do, building two jacks into the back of the docking station would have been a tidier and more convenient solution.—*MJ*

First Looks

TP6

CONTINUED FROM PAGE 33

Undoubtedly, Version 6.0's crowning glory is Turbo Vision, a library of objects that comprise a complete application framework. You can think of an application framework as the skeletal structure of a program without the flesh. Your programming task is to add the program specifics to the skeleton.

Objects in the Turbo Vision library include character-based windows, pick lists, scroll bars, menus, checkboxes, radio buttons—all the items that make up a modern program. The event-driven style is similar to that of Presentation Manager or *Windows*, though the compiler does not generate *Windows* code.

Turbo Vision is based on event handling, and not standard procedural programming. All user input passes through the application's GetEvent method, which interprets the input and generates, for example, a "KeyDown" event. This event gets passed first to the main application's HandleEvent method. If it can handle the event, it does so, performing some appropriate action. If not, it passes the event to the selected object among its subobjects. The subobject either handles the event or passes it along to its selected subobject. There are also "broadcast" events that go to every object and "message" events between objects.

Turbo Vision objects automatically respond to certain common events. For example, clicking on any window will bring it to the top of the window stack and make it current. You can move a window by dragging its top edge, and resize it by dragging the bottom right corner. And the nice part is that all of this comes with no programming effort on your part.

To write a Turbo Vision program, you initialize the necessary objects and equip them to handle coming events. For example, the MenuBar object type is built in; all you need to do is specify the captions for each menu option and the command event to be generated when the user chooses that option.

If you devise a specialized editing window, you simply give it the ability to process particular editing keystrokes. You also get some "bonus" objects in Turbo Vision: A clock, Rolodex, calendar, and calculator all come with source code.

The most significant change to the compiler itself is the introduction of private fields and methods for objects. The new Private keyword makes the specified fields and methods inaccessible outside of the current unit. In strict object-oriented programming, you never access an object's data fields directly—but before the existence of private fields and methods there was no way to enforce this rule.

Another new keyword, far, tells the compiler to make a particular procedure or function FAR without affecting any other procedures. This is a big improvement over the existing {$F+} and {$F-} directives. Other enhancements include pointer constants, optional 80286 code generation, and fewer restrictions on what sort of OBJ files can be linked into TP programs.

The heap manager returns to the style of TP 3, allocating memory in chunks rounded to 8 bytes. This granularity helps prevent heap fragmentation, but it also may cause trouble in programs that depended on the specific behavior of the heap manager.

As with previous versions, a $299.95 *Professional* version of the package adds Turbo Debugger, Turbo Assembler, and Turbo Profiler. *Turbo Pascal Professional* also gives you a compiler that can make use of extended memory to let you compile bigger programs. The TPCX command-line compiler doesn't create protected-mode programs, but with a megabyte or more of extended memory, it runs in protected mode.

When Turbo C got its chic new IDE, Turbo Pascal users could only gnash their teeth. Now TP 6 offers a thoroughly modern IDE—a CUA-compliant desktop with multiple editing windows. Source code files are no longer limited to 64K—you can edit files up to a megabyte in size with up to 32,767 lines. As a matter of fact, the entire IDE is written using Turbo Vision.

If you like the IDE's dialog box for selecting a file, grab it from the Turbo Vision library and incorporate it into your own program. Ditto the pull-down menu system and other program elements. And if the new IDE doesn't do everything you want it to you can use the macro compiler to create your own hot-keyed commands.

The new IDE stashes editor data and some system resources in extended memory, if it's available. You might think that this would give you more RAM for developing larger programs, but the fancy IDE has serious RAM costs. In fact, you can't create substantially bigger programs than you could using the older Version 5.5.

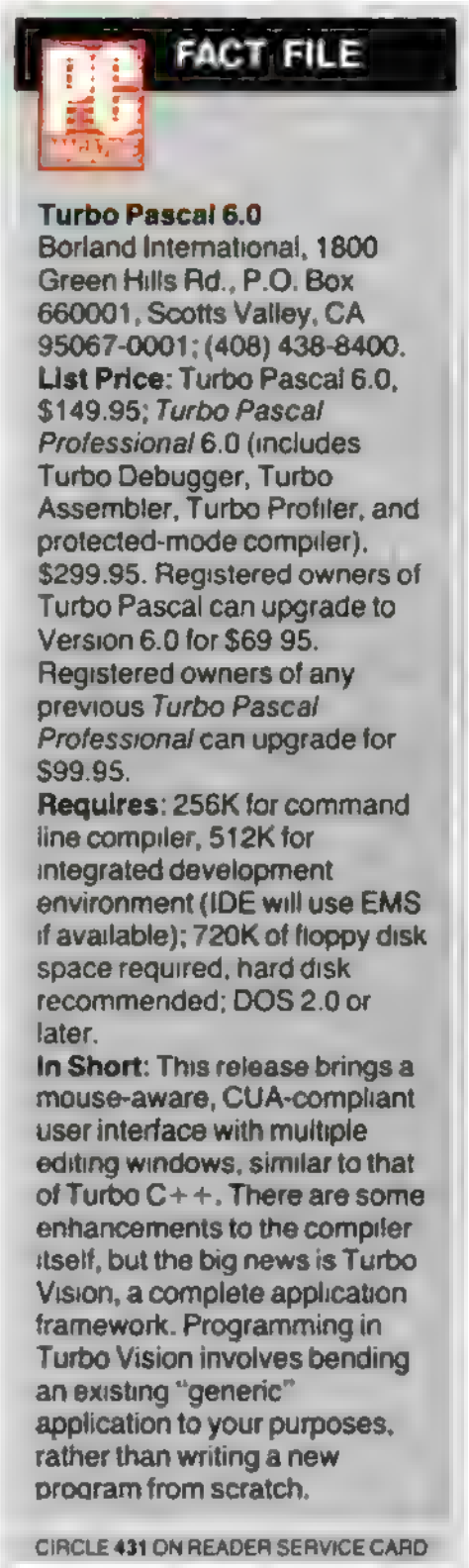
If you've ever written a serious Interrupt Service Routine in old-style INLINE code, you'll recall it was a painful task. Not only did you have to either memorize or look up the bytes for each assembler opcode, you had to laboriously count bytes for each JUMP statement. With BASM, you simply write out the opcodes by name and define labels for jumps.

There are minor limitations. For example, you must only access variables that are local to the current scope or fully global. Still, it's a vast step beyond INLINE code. Note also that BASM doesn't shell out to Turbo Assembler; it's built in.

The art of built-in debugging takes a leap forward as well. For touchy assembler routines, you can single-step through BASM code—the new Registers window keeps track of what's going on in the CPU. Breakpoints have also improved. In the past they were just plain dumb. Every time you reached a breakpoint, execution would stop and you'd pop into the built-in debugger.

Initially, only the standalone debugger had clever pass-count breakpoints (break after passing the point a certain number of times) and conditional breakpoints (break only if a certain condition is true). With TP6, pass-count and conditional breakpoints are now built in. You can set a breakpoint in a HandleEvent method to trigger only when it sees a mouse event, or only on the 100th pass.

In all, Turbo Pascal users can stop lusting after the Turbo C's IDE—they've got it! And they can stop counting INLINE bytes for time-critical functions and use BASM instead. Finally, Turbo Vision makes it easy for any TP programmer to write programs that look and feel professional. Sure, you've barely recovered from absorbing object-oriented programming, and now Turbo Vision's event-driven programming is another shock. But the technique is worth learning, both for the utility it offers in creating programs with a standard user interface and for its similarity to the style of programming in the popular GUI environments. ■



FACT FILE

Turbo Pascal 6.0
Borland International, 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067-0001; (408) 438-8400.
List Price: Turbo Pascal 6.0, $149.95; *Turbo Pascal Professional* 6.0 (includes Turbo Debugger, Turbo Assembler, Turbo Profiler, and protected-mode compiler), $299.95. Registered owners of Turbo Pascal can upgrade to Version 6.0 for $69 95. Registered owners of any previous *Turbo Pascal Professional* can upgrade for $99.95.
Requires: 256K for command line compiler, 512K for integrated development environment (IDE will use EMS if available); 720K of floppy disk space required, hard disk recommended; DOS 2.0 or later.
In Short: This release brings a mouse-aware, CUA-compliant user interface with multiple editing windows, similar to that of Turbo C++. There are some enhancements to the compiler itself, but the big news is Turbo Vision, a complete application framework. Programming in Turbo Vision involves bending an existing "generic" application to your purposes, rather than writing a new program from scratch.

CIRCLE 431 ON READER SERVICE CARD

After a False Start, R:BASE 3.1 Comes on Strong

HANDS ON
by Joe Salemi

After a few less than auspicious upgrades, *R:BASE* 3.1 looks good. When *R:BASE* 3.0 was released (First Looks, June 26, 1990), it was justly criticized for its excessive memory requirements, sluggishness, and lack of built-in EMS support. Microrim almost immediately announced the August release of 3.1, a free upgrade from 3.0, to address these problems.

In August, *R:BASE* 3.1 was released but then quickly pulled off the market and back into beta, due to continuing memory problems. It has finally been released after a two-month delay, and it delivers on almost everything promised by Microrim. In addition, 3.1 has the ability to directly address *dBASE* files (see sidebar).

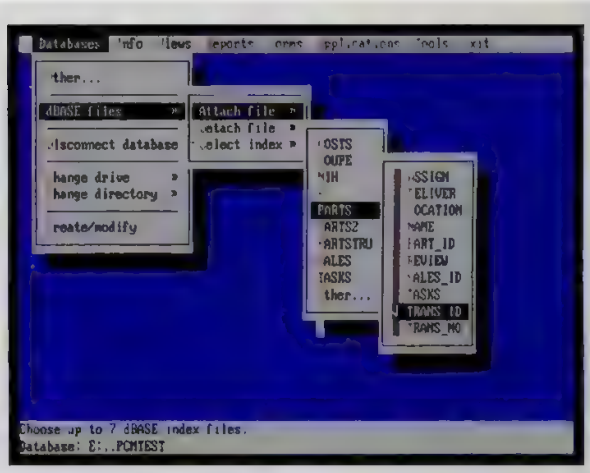
The most significant changes in *R:BASE* 3.1 are in the areas of speed, mouse support, and memory management. Overall, this version is much more responsive than 3.0—informal tests show that it is closer to its predecessor (the original *R:BASE for DOS*) in speed. Mouse response has been improved as well, with no discernible lag between clicking on a menu item and *R:BASE*'s execution of the selected action. The mouse can now also be used to lay out fields when designing forms or reports.

The biggest improvement is in memory usage; the minimum free memory required by 3.1 is 450K, down from the 520K required by 3.0. Support for EMS 3.2 or better is now standard, and on an 80286 or better processor, XMS memory can be used as well (through either the supplied HIMEM.SYS driver, or a 386/486 memory manager). Microrim also supplies a utility called RVMX.COM that lets DOS access to up to 96K of the video memory on an EGA or VGA card. Using this memory can crash some graphics applications, so access to it can be toggled on and off.

R:BASE 3.1's use of EMS is not entirely bug-free, however. On some systems using Qualitas' *386MAX* 5.0, 3.1 would refuse to load, exiting with an EMS error. Microrim acknowledged the problem, attributing it to both the way *386MAX* remaps memory, and the way 3.1 handles the ZIP function (which swaps *R:BASE* out to EMS to execute a subprogram or DOS command). The support technician I spoke with suggested using the "-R" command line switch, to avoid the logo screen. This allowed 3.1 to load on a Northgate 386/20; however, the program again crashed while trying to access a *dBASE* file. The technician also suggested using the NOCOMPROM parameter in *386MAX*, but this didn't solve the problem. On the same system using HIMEM.SYS and the EMS driver provided with *Windows* 3.0, and on a PS/2 Model 80 with *386MAX*, 3.1 loaded and ran without problems.

Microrim has also addressed some of the other complaints that users had about *R:BASE* 3.0. Error handling has been improved, and error messages now appear on the screen when output is being redirected to a printer or file. A pick list now appears when you use the menu to change your working drive or directory. Keyboard mapping has been extended to include Alt-function and Alt-number keys. When you define a query, you can now save the screen layout for future use in Browse/Edit screens.

Overall, the improvements to *R:BASE* 3.1 are significant, and solve just about all the problems exhibited by Version 3.0. Unless you are using *386MAX*, there is no longer any reason to hold off on upgrading from *R:BASE for DOS*. ■



To access *dBASE* files from within *R:BASE* 3.1, you simply pick and choose the data and index files from a menu.

R:BASE DOES dBASE

R:BASE 3.1 can directly read and write *dBASE III* and *III Plus* data and index files. It can also read and write nonencrypted *dBASE IV* data files, when *R:BASE* isn't in multiuser mode. This represents a significant improvement over prior versions of *R:BASE* (which could only import or export *dBASE III* files). The direct read/write capability is derived from Microrim's now-dormant VANGUARD project—an attempt to create an all encompassing DBMS.

In order to use *dBASE* files inside *R:BASE*, you must already have an *R:BASE* database open. This can be a "dummy" database, used only to hold the tables *R:BASE* uses to handle the necessary translations. The new ATTACH command is used to open a *dBASE* data file (with up to seven index files), and associate it with the *R:BASE* database. The *dBASE* files are automatically attached whenever the *R:BASE* file is opened. DETACH is used to break the association.

There are limitations on how *R:BASE* works with *dBASE* files, particularly in multiuser mode, due to different data-storage methods, and the relational nature of *R:BASE*. An "*R:BASE* 3.1 Enhancements" guide describes how *R:BASE* works with *dBASE* files, and includes a chart detailing which *R:BASE* commands work differently with *dBASE* files, as well as those that don't work at all. Also included is an "*R:BASE* for *dBASE* Users Guide" which has charts that cross-reference commands.

Adding this ability to *R:BASE* 3.1 was a stroke of marketing genius since 3.1 represents a serious alternative for *dBASE III* users who are hesitant to move to *dBASE IV*.—*JS*

FACT FILE

***R:BASE*, 3.1**
Microrim, 3925 159th Ave. NE, Redmond, WA 98052; (206) 885-2000.
List Price: $795 (upgrade free for 3.0 owners).
Requires: 640K RAM, 4MB of hard disk space, DOS 3.1 or later
In Short: *R:BASE* 3.1 delivers on the promise of Version 3.0, addressing most of the problems with the previous release. Its ability to directly use *dBASE* files makes it a serious contender to *dBASE IV*.

CIRCLE 434 ON READER SERVICE CARD

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CIRCLE 299 ON READER SERVICE CARD

5,000 Colors from In Focus's $5,995 LCD Panel

HANDS ON
By Alfred Poor

The 5000CX PC Viewer from In Focus Systems is a $5,995 VGA-resolution LCD projection panel that establishes a new standard for color projection displays. While panels are still no match for traditional analog display devices (see sidebar), this one comes closer to producing the full-color images we see on a typical monitor. The 5000CX is capable of producing nearly 5,000 different colors, according to In Focus product specifications.

The 7.5-pound panel uses TSTN (Triple Super Twist Nematic) technology, a design developed and patented by In Focus Systems. The design uses thin layers of plastic on either side of each LCD layer to correct for color shifts and to increase contrast. This replaces double-twist designs that use more LCD layers, adding to the thickness of the panel.

The 5000CX uses three of these separate LCD layers. These are colored cyan, yellow, and magenta rather than the red, green, and blue used in CRT monitors. Because of this, and because LCD panels cannot produce as many discrete shades as a monitor, the projected colors do not always match the monitor's image.

The colors look great, however. There is an excellent balance between the cyan, magenta, and yellow levels. Trim adjustments on the side of the panel let you fine-tune the image. I found that it was difficult to improve on the factory settings, however.

With the 5000CX, blues were blue and yellows were vivid. Red shades tended to be slightly off. Some pink and purple shades shifted to the red side of the spectrum; light green shades were too dark. Despite this, the overall effect was striking. In a few instances the panel had some trouble with vertical ghosting: It displayed bands where a light part of the image washed out a vertical stripe on the screen. But this effect could be minimized by adjusting the picture controls.

From a technical standpoint, the panel performed about as you would expect from a high-end projection panel. The contrast ratio was high: nearly 10 to 1. On the other hand, light absorption was also high: Despite the TSTN design, the panel soaked up nearly 94 percent of the light from the projector. Because of this, in Focus recommends using a projector with up to 650-watt ratings.

The panel also features a built-in cooling fan, and the front panel controls are duplicated on a remote control. The 5000CX supports signals from CGA, EGA, and VGA adapters, as well as from the Macintosh. If you want to drive a monitor at the same time as the panel, you will need the optional VGA breakout box, which costs $199.95.

For absolute top quality in a projected color image, you still need to go to projection video, which can range in cost from about the same to a few thousand dollars more than the 5000CX. Projectors are far less transportable and more difficult to install and maintain. If color that is almost as good as that on a monitor is good enough for you or you need a projection system that is easily portable, the 5000CX is your best bet. ■

LCD panels come a step closer to full-color capability with the 5000CX PC Viewer.

PHOTOGRAPHY: THOM O'CONNOR

FACT FILE

5000CX PC Viewer
In Focus Systems Inc., 7770 Southwest Mohawk St., Tualatin, OR 97062; (800) 327-7231, (503) 692-4968.
List Price: $5,995; VGA breakout box, $199.95
Requires: CGA, EGA, or VGA video adapter.
In Short: The 5000CX is the best full-color LCD projection panel so far.

CIRCLE 447 ON READER SERVICE CARD

5,000 COLORS: Too Many or Too Few?

Why do you need 5,000 colors from your LCD when your VGA displays only 256 colors?

Prior to the release of the In Focus 5000CX PC Viewer with its 5,000 colors, there were other color panels with support for about a tenth as many colors—for example, the Proxima VersaColor with 512-color capability.

It would seem that 512 colors should be plenty to produce a good image, and 5,000 is far more than could ever be needed. After all, standard VGA images in their coarse 320 by 200 resolution require only 256 colors, and the high-resolution 640 by 400 mode only uses 16 colors.

The problem is that these specifications apply not to the display, but to the display *adapter*. A VGA card can produce either 256 or 16 colors at a time, depending on the resolution, but these colors are selected from a much larger palette. In fact, the adapter is capable of generating signals for 262,144 different colors. The limiting factor is how many it can produce at one time.

So, a color display device needs to be evaluated not in terms of how many colors it produces at once, but rather how many different color signals it can respond to at all.

Bulky vacuum tube color monitors with their analog circuitry are capable of producing a nearly infinite range of colors. The voltage to the individual phosphors can be varied across a wide range of levels, making it possible to display more shades than the eye can distinguish.

By contrast, LCD panels can only produce a small fraction of the colors offered by standard monitors. While tube phosphors are analog devices, LCD pixels are essentially binary—either they are on or they are off. LCD manufacturers have developed ways around this, such as turning a pixel on and off rapidly so that it is mostly on or mostly off, which permits the creation of additional shades.

But 5,000 colors still is less than 2 percent of the total number of colors that can be produced by a VGA adapter, and 500 colors gives less than 0.2 percent coverage. It stands to reason that despite the amazing capabilities of these devices, they are still short of offering the full-color capability that we expect from a computer display.—*AP*

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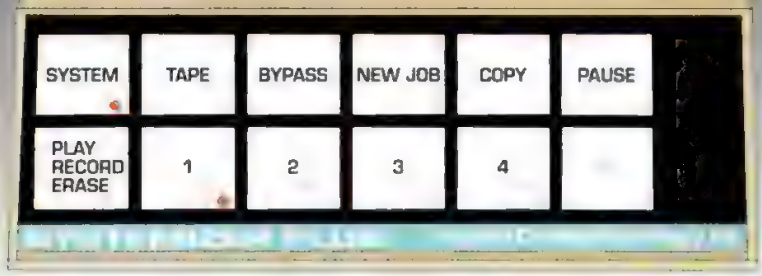
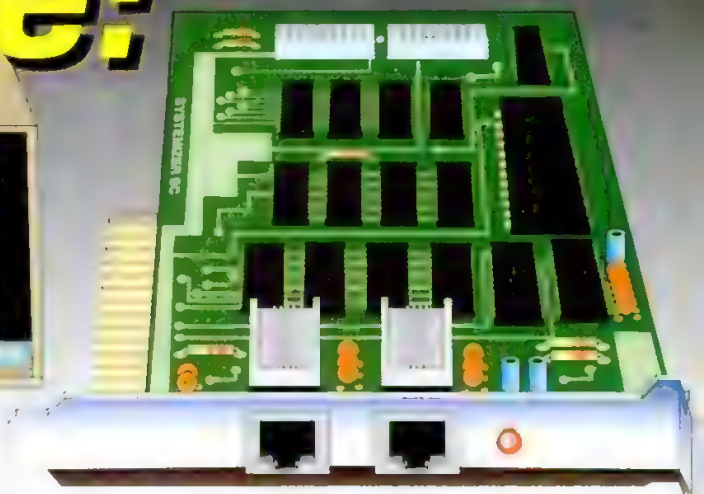


Several models available. The **Systemizer® Plus** shown above is an externally mounted networking module. Because it's self-contained and requires no software in the computer, it can work with practically any computer, operating system and application program



Or use the internally mounted **Systemizer® SC**, a slot-card version of the Systemizer Plus. For MS-DOS® PC's and compatibles. The SC and Sys+ can be used in the same network, as shown in the diagram below

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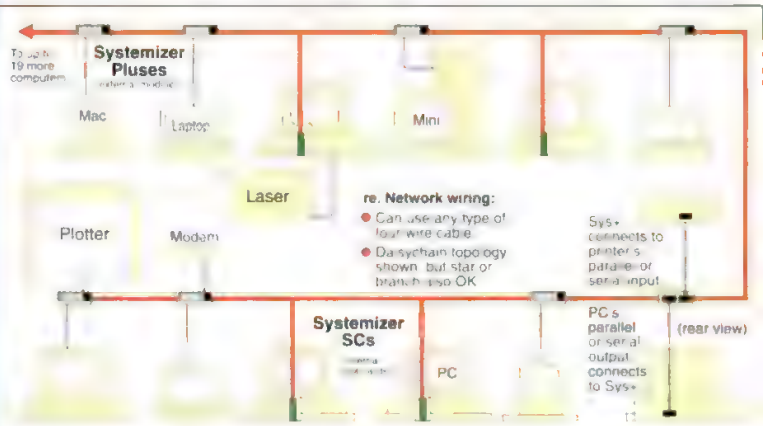

Example Systemizer network consisting of 11 micros *and* a minicomputer, sharing 3 printers and a modem via a mixture of Systemizer Pluses and Systemizer SCs. Note, though not shown here, some of the computers could also be connected to a traditional LAN or WAN

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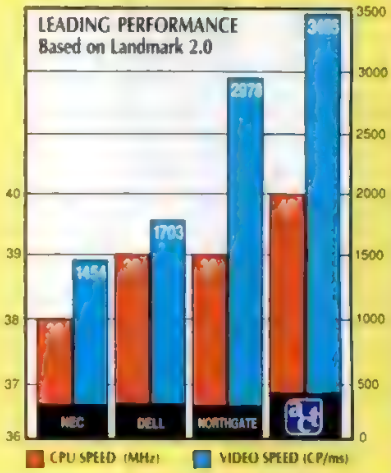

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Artline: Heft for Illustrators, Ease-of-Use for Novices

HANDS ON
by Linda Simons

Common wisdom has it that you can't be all things to all people, but *Artline* 2.0 very nearly manages to be all things to all illustrators. This $595 *GEM*-based vector drawing program from Digital Research lets novices easily create pictures. At the other end of the user spectrum, professional designers will turbo-charge their work using the Color, Layer, Font, and Tool Manager menu options.

Twenty-one icons give instant access to most of *Artline*'s vector-drawing functions. You can create rectangles, lines, ellipses, curves, and freehand shapes, as well as enter text in one of 35 scalable typefaces. Attributes such as color or fountain fills, are assigned with a simple mouse click. And tools that rotate, flip, and skew objects allow you to create special effects effortlessly.

Two brand new drawing tools—the Sketch and Quill—let you use Bezier curves. As you drag the sketching cursor around the screen, *Artline* automatically fits the best curve to your rough drawing.

The Quill function requires that you simultaneously create both a curve's anchor point and its associated tangent control lines. While this approach demands an understanding of how the direction and length of the tangents affect the shape of a Bezier curve, the precision it affords is worth the effort.

Don't buy *Artline* for its text-handling capabilities. Although the program can handle sophisticated effects like aligning text to a curved path, it overlooks such essentials as manual kerning for display type.

Do buy *Artline* for its unique approach to tracing bitmapped images. An unusual feature allows you to interrupt a trace midstream and change the sensitivity settings. This means that you can conserve memory (by having fewer points and smoother curves for the simple portions of an image) while maintaining accuracy.

As well as all of the expected functions (such as copy or paste, and group or merge), *Artline*'s menus also offer advanced features. "Masking" clips an overall pattern to the shape of another object, while the "Blend" command performs shape and color interpolations between two unlike objects.

Unfortunately, the most important tool in *Artline*, the plane tool—which allows you to edit Bezier curves—is plain annoying. In order to bring up the plane tool's dialog box, for example, you must double-click somewhere on the drawing screen away from the object itself. Half the time this deselects the object altogether.

The preset viewing levels seem restrictive until you realize that you can create, save, and name a custom view of your drawing. The next time you load the file, you can choose that view from the toolbox.

The most powerful management functions of the program hide under an innocuously named Options menu. *Artline*'s Color Manager lets you develop palettes (including gradient fills) that can be saved and used with other drawings. With the Layer Manager you can segregate specific portions of a complex drawing in discrete, transparent, overlapping "pages." By displaying only the pertinent layers you can vastly simplify the image editing process.

The Font Manager lets you print letters using internal typefaces either as vector outlines or as downloadable PostScript-compatible fonts. Also, you can convert third-party typefaces from Bitstream, *The Fontagrapher*, and Adobe to *Artline*'s proprietary .AF4 format.

The Tools Manager gives you the power to customize both the function and the look of the toolbox. The Tool Manager comes complete with a (bitmapped only) icon editor. New icons can be task-specific tools, like a stylus that only draws dotted lines at a preset angle, or they can trigger a series of menu commands and functions.

Artline still runs under the *Graphical Environment Manager*, or *GEM*, interface. However, in contrast to the traditional GEM applications, *Artline* 2.0 makes substantial demands on system resources. It requires 505K of free RAM, 3.5 megs of disk space, and an additional 512K of disk space for swap buffers. I couldn't run any TSRs along with *Artline*, and found screen redraws to be intolerably slow unless I worked in wireframe mode. Expanded memory should solve some of these performance problems.

More troublesome than the *GEM* interface is the *GEM* file format. Don't misunderstand; the *GEM* format handles sophisticated images and is compatible with major applications. *Artline*, however, can only read files stored in either .GEM or *Adobe Illustrator* .AI formats and can only export images to .GEM or .EPS files. Real-world applications require .TIF, .CGM, and .WMF files—none of which *Artline* can generate. Digital Research plans to bundle the *Hijaak* translation utility with *Artline* 2.0. Registered users should contact the company for more information.

Although it does support industry standards, *Artline* comes with a limited collection of printer drivers. You must use an awkward, separate menu to output PostScript files. A thorough manual is some small compensation for the total absence of on-line help.

Legitimate criticisms notwithstanding, the new version of *Artline* can compete with programs like *CorelDRAW!* or *Arts and Letters Editor*. If you are willing to spend some time customizing the palettes and toolbox, you could make *Artline* the application glove that fits your illustration hand. ■

Rotate and flipper tools make short work of this headdress. The individual hairpins were duplicated, mirrored, and spun into position. The image was printed on an HP PaintJet.

FACT FILE

***Artline*, Version 2.0**
Digital Research Inc., 70 Garden Ct., P.O. Box DRI, Monterey, CA 93942; (408) 647-6675.
List Price: $595.
Requires: 640K RAM, 80386 or higher, mouse, DOS 3.0 or later.
In Short: Bezier curves, an interactive tracing tool, and a customizable toolbox most definitely make *Artline* 2.0 a good buy at $595. The only drawbacks are the *GEM* interface, which is showing signs of strain, and the limited file-export capabilities.

CIRCLE 446 ON READER SERVICE CARD

Legacy 3.0: Word Processing and Desktop Publishing In One Windows Package

HANDS ON by Edward Mendelson

Legacy 3.0—NBI's $495 document processing package—seizes the middle ground between *Windows*-based word processors and desktop publishing programs. Its combination of typographic features and formatting conveniences may make it the document-production program you need unless you can't live with its minor limitations.

Legacy uses stylesheets for text formatting, and lets you edit text either in WYSIWYG or draft mode. In WYSIWYG mode, *Legacy* is frame-based, like *Ami Professional* or *Ventura*. Before you can enter text, tables, or graphics, you create a frame. The frame can have customizable borders, colors, dimensions, and links to other frames or use DDE links to other applications.

When you link two or more frames, *Legacy* gives you unique formatting features. For example, you can divide a table between two linked frames, and have columns or rows spill automatically into the second frame. You can superimpose frames to create irregular shapes, but you can't automatically create irregular frames around imported graphics.

An icon bar enables you to switch between editing text or graphics and editing the frame that contains them. This icon bar somewhat resembles the "ribbon" in *Word for Windows*, but has a fuller set of tools. When you edit graphics, for example, the icon bar replaces its text-formatting tools with graphics tools for creating lines, arcs, and boxes.

When you switch to draft mode, *Legacy* uses codes to mark off areas of formatting. These codes can be searched or deleted. Unfortunately, the Undo command won't restore a deleted code, and the draft mode font is ugly.

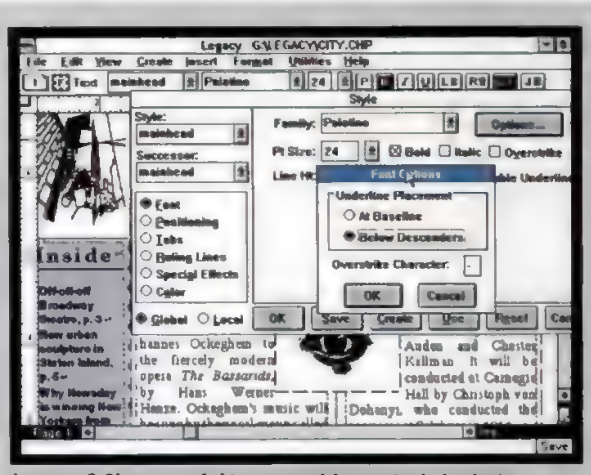
Legacy's search-and-replace function lets you use wild cards in both the search and replace strings; a thesaurus with antonyms and definitions; automated and customizable drop caps, and the most precise typographic controls available on a PC short of *Ventura*'s.

Legacy's weaknesses include size (about 5MB of disk space), inability to open two files at once, lack of macros, and limited keyboard shortcuts.

If you struggled with NBI's ill-fated *Windows* 2.*x* document processor, *Legend*, don't give up hope on the new one. *Legacy* has sleek menus and is faster. While it isn't as high-powered a word processor as *Word for Windows* or *Ami Professional*, or as rich a desktop publishing program as *PageMaker* or *Ventura*, it's the only *Windows*-based program that gives you most of the best features of a word processor and a high-end DTP package. ■

List Price: *Legacy* 3.0 $495. **Requires:** 80286 or higher processor, 640K RAM (2MB recommended), graphics adapter, mouse, *Windows* 3.0, DOS 3.2 or later. NBI Inc., 3450 Mitchell La., P.O. Box 9001, Boulder, CO 80301; (303) 444-5710.

CIRCLE 701 ON READER SERVICE CARD



Legacy 3.0's powerful typographic controls include underline placement, customized bullets, and dropped capitals, all within flexible stylesheets.

Hayes Enhanced Serial Port Breaks the Bottleneck

HANDS ON by Mike Byrd

You may have the fastest 486 PC and the latest V.32/V.42bis modem, but a hidden bottleneck could be robbing you of all the throughput you paid for. PC serial ports often have trouble handling data flow between fast processors and modems. The $299 Hayes ESP Enhanced Serial Port card can eliminate data loss and enhance CPU performance during communications sessions.

The ESP takes advantage of the new 16550 UART (Universal Asynchronous Receiver Transmitter), which controls the serial port. The 16550 UART offers a 16-byte FIFO (first-in, first-out) buffer that mediates the flow of data between the serial port and the CPU. (If your present UART is one of the few in a socket, you can buy a 16550 for under $15 and make a direct replacement.) The 16550 acts like the older 16450 UART until the communications software activates the FIFO buffer. Then incoming data is queued until the CPU can accept it. Communications programs with 16550 compatibility include *QMODEM*, *ProComm Plus*, *Telix*, and *HyperAccess 5*.

The Hayes ESP card also provides an on-board 8031 processor for direct memory access (DMA) data transfers. This allows 1K bidirectional data flow for bit rates up to 57.6 Kbps. It supports the public domain Enhanced Serial Interface (ESI) specification, allowing software support of high-speed data transfers under DOS or OS/2.

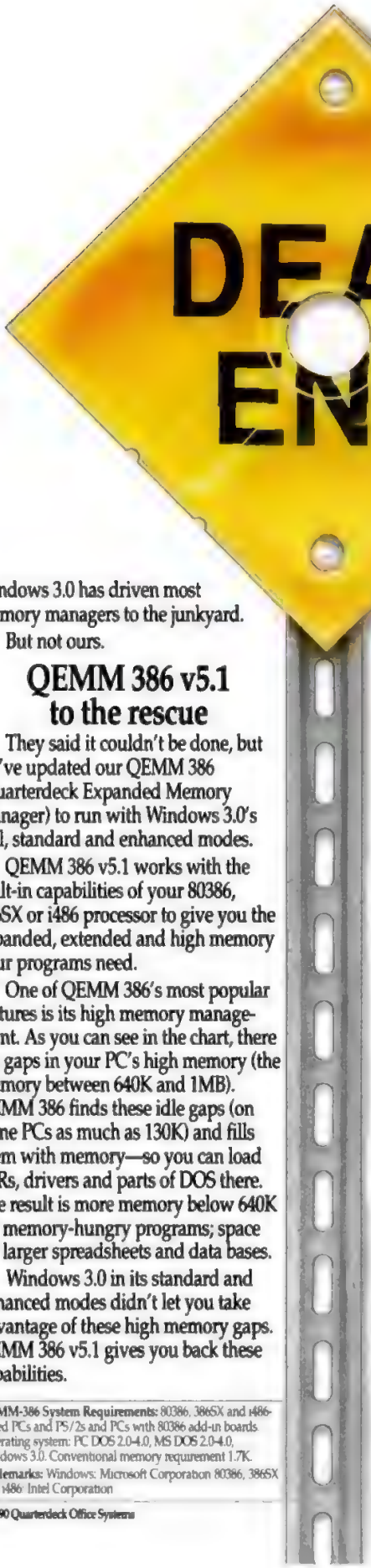
The ESP is a full-length, 8-bit serial card with two comm ports. It contains two 16550 UARTs. DIP switches allow the ports to be assigned as COM1 through COM4. The back of the board has two 9-pin RS-232C male connectors. The card comes with an OS/2 driver and an installation program.

Once installed, the board's operation is transparent. ESI-compliant software automatically selects the DMA enhanced mode which takes advantage of the ESP's microprocessor. Presently, the only fully ESI-compliant software is Hayes's *Smartcom Exec*. Others should include ESI very soon.

Preliminary testing showed the ESP's value in interrupt-intensive operations. In one series of tests, we had to slow down a 16450 UART board to 19,200-bps port speed to complete V.32/V.42bis file transfers in a network environment. The ESP board easily completed the same tests at 38,400-bps port speed in the FIFO mode. File transfers in the DMA mode were swift. With the ESP board directly transferring data to memory, the CPU is free to do other tasks. ■

List Price: Hayes ESP Dual Enhanced Serial Port, $299 for XT/AT/EISA PCs, $349 for MCA PCs. Hayes Microcomputer Products Inc. 705 Westech Dr., Norcross, GA 30092; (404) 441-1617.

CIRCLE 702 ON READER SERVICE CARD



If your memory manager has no future under Windows, trade up to QEMM.

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QEMM 386 v5.1 works with the built-in capabilities of your 80386, 386SX or i486 processor to give you the expanded, extended and high memory your programs need.

One of QEMM 386's most popular features is its high memory management. As you can see in the chart, there are gaps in your PC's high memory (the memory between 640K and 1MB). QEMM 386 finds these idle gaps (on some PCs as much as 130K) and fills them with memory—so you can load TSRs, drivers and parts of DOS there. The result is more memory below 640K for memory-hungry programs; space for larger spreadsheets and data bases.

Windows 3.0 in its standard and enhanced modes didn't let you take advantage of these high memory gaps. QEMM 386 v5.1 gives you back these capabilities.

QEMM-386 System Requirements: 80386, 386SX and i486-based PCs and PS/2s and PCs with 80386 add-in boards. Operating system: PC DOS 2.0-4.0, MS DOS 2.0-4.0, Windows 3.0. Conventional memory requirement 1.7K.

Trademarks: Windows: Microsoft Corporation 80386, 386SX and i486: Intel Corporation

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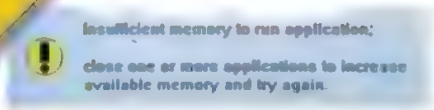

When Windows 3.0 says there's not enough room to run your DOS programs, it's just trying to tell you it needs QEMM 5.1.

QEMM 386 has many more features. For example, there's *Optimize* to assist you in loading programs in high memory. And there's *VidRAM* that lets you use the EGA/VGA (as much as 96K) video area when you aren't running graphics.

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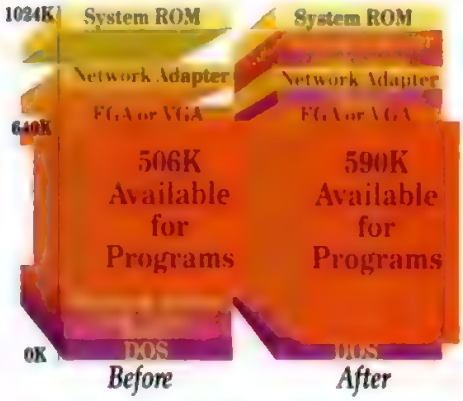

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* If you purchased QEMM 386 5.0 on or after June 19, 1990, you are eligible to receive this upgrade free of charge. Simply send proof of purchase with your registration card.
** To registered owners only.
*** Enclose the original cover of your current memory manager users manual(s) in order to get this special price. Offer expires 12/31/1990. For this upgrade offer, Windows 3.0 is not considered to be a memory manager.

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WinComm Builds Beautiful Communications Scripts

HANDS ON by Barry Simon

Synappsys' $149 *WinComm* communications program for *Windows* 3.0 enters a crowded field, but it carves out a niche for itself as the tool of choice for creating spectacular front ends for scripted communications. *WinComm* does this with three sets of interface generators that offer support for graphics screens, a richer set of dialog box tools, and graphics editors for dialog boxes and displays.

WinComm's script commands can display *Windows* bitmaps (.BMPs) or metafiles (.WMFs), and decorate them with hotspots and buttons. Scripts can call up dialog boxes with edit boxes, radio buttons, and check boxes. *WinComm* scripts have the unique capability to display file list boxes, drop-down list boxes, and combo controls, and they also offer a complete implementation of DDE.

Two support programs allow you to generate code for *WinComm* applications without directly writing it. A dialog editor lets you construct a dialog box out of objects you choose from a menu. Once the box looks the way you want it to, you send the underlying code (in *WinComm*'s script language) to the clipboard and paste it into your favorite editor. And you can paste back from your editor to modify the dialog. The second support program, *WCUTIL*, lets you display .BMPs and .WMFs on-screen, draw hotspots and buttons, add help, and then paste the code to the clipboard.

Added to the front-end tools is support for file-transfer protocols and terminal emulations. Supported protocols include X, Y, and Z modem, CompuServe B, and Kermit. *WinComm* will resume interrupted CompuServe B and Z modem transfers but it does not include a Kermit server mode.

WinComm supports ANSI BBS, VT 52/100, and CompuServe Vidtex. The Vidtex support includes the ability to view .RLE graphics files on-line. Alas, .GIF files—which have replaced .RLE in most places on CompuServe—do not have this on-line support.

Also included are a master/slave mode connection, and a phone dialer which is limited when compared to packages like *Hotline*.

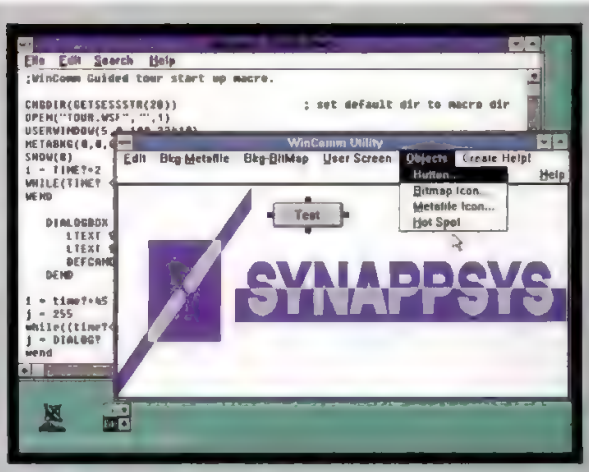
The program has a few flaws. Some of the built-in dialog boxes have visual bugs: The dialog box buttons don't line up in the dialer dialog box, and the file list box in the Kermit-upload dialog box partially overwrites some of the buttons.

Given the broad functionality of the program, the documentation is uneven. You have to figure out large parts of the program by trial and error. The effect of the sparse documentation is worsened by a limited manual index and some nonintuitive points in the user interface. *WCUTIL*, for example, has no File/New command. In lieu of this basic option, you must pick the single submenu item on the fourth menu bar choice in order to start out.

If you are a sophisticated user responsible for producing communications scripts for a department or corporation, run out and get *WinComm*. Otherwise, wait until some of the rough edges are smoothed. In any event, keep an eye on what I find to be the most promising and intriguing *Windows* communication program yet. ■

List Price: *WinComm*, Version 1.0, $149. **Requires**: *Windows* 3.0, DOS 3.1 or later. Synappsys, 401 W. Main St., Norman, OK 73069; (405) 366-6363.

CIRCLE 446 READER SERVICE CARD



WinComm's graphical script generator incorporates graphics, dialog boxes, and buttons.

Handy Macro Editor/Debugger for Lotus 1-2-3 2.x

HANDS ON by Craig Stinson

People who write *Lotus 1-2-3* work in a language that's inadequately documented, lacks structured programming constructs, and never in its eight-year history has had decent debugging tools. Never until now.

Personics' *Macro Editor/Debugger (MED)* is a $199.95 add-in that threatens to make *1-2-3* macro development fun. *MED* is a two-purpose tool. The debugger tracks down problems and the editor fixes them. Since the editor lets you create and modify range names by typing the names into cells, you can use it to create new macros.

MED occupies the lower half of your screen. In debugger mode, it splits into two windows—one showing the current code context, the other displaying the status of watchpoint variables and the address of the current subroutine's caller.

F2 invokes the editor and up to three windows, allowing you to work with range names, code, and comments at once.

You can monitor up to four watchpoints and set nine breakpoints. The latter can be of three types: "execute" (stop when execution comes to a particular cell), "update" (stop when a particular cell's value changes), and "conditional" (stop when a logical expression becomes true). You can attach a count value to any breakpoint, so execution stops on the breakpoint's nth occurrence.

Macros can be traced in two step modes: one instruction at a time and one cell at a time, or at nearly full speed. In either mode, you can jump through loops at full speed. While tracing, *MED*'s code window shows the macro's next six instructions, even if they're in separate subroutines. Any time execution is paused, you can move the pointer through your code to restart at a new location. You can also invoke the editor, make changes, and restart—all without leaving *MED*.

On top of these (and other) services, *MED* provides comprehensive diagnostic and informational messages. It will distinguish between the various types of I/O errors, tell you when arguments are of the wrong type, and report typing errors (such as missing parentheses) in simple English.

If you do serious development in *1-2-3 2.x*, *MED* will preserve the hair on your head. ■

List Price: *Macro Editor/Debugger*, $199.95. **Requires**: *Lotus 1-2-3*, Release 2.0, 2.01, or 2.2 (uses about 70K of memory). Personics Corp., 63 Great Rd., Maynard, MA 01754; (508) 897-1575.

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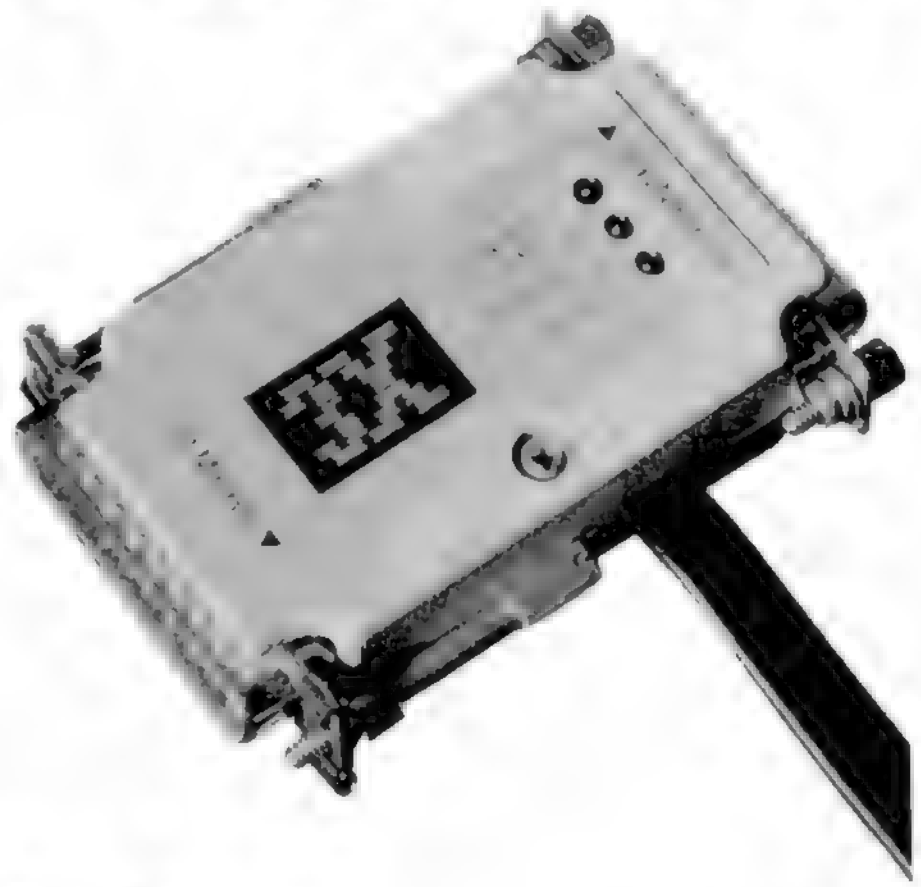

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CIRCLE 234 ON READER SERVICE CARD

3X USA

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Blazing Speed: NCR's 6436-0301 SCSI Printer

HANDS ON
by Robert W. Kane

How many times have you sat at your computer waiting, waiting, waiting for your laser printer to spit out a full-page 300-dpi graphics image? While you can speed up the process (fast computer, fast printer, print buffer), the biggest bottleneck is something you can't control: the speed of the parallel port. NCR Corp. has done something about the problem. With their 6436 SCSI printer, waiting for graphics to print is an anachronism.

Let's make no bones about it: The 6436 is the fastest printer ever to run the PC Labs printer graphics speed test. While other fast printers hooked to the parallel port have run at 2 graphics pages per minute, the 6436 zooms by those slowpokes. It churns out 4.4 gppm running in HP LaserJet II emulation.

This phenomenal throughput comes via a combination of the SCSI interface and the Ricoh 4150 15-ppm laser engine. The NCR SCSI printer is based on the same engine and similar design to the NCR G436-0501 (reviewed November 13, 1990), but exhibited none of its HP compatibility problems. However, the 6436-0501 offered optional PostScript compatibility; there is no such capability available for the SCSI printer at this time.

While it lacks PostScript support, it does have 36 resident internal fonts in 7 different typefaces. You can select any of the fonts as the default, but unless you have an NCR 6436-0301 driver built into your application, you cannot access them during a session.

Another advantage the SCSI printer and all 6436 NCR printers enjoy is having both interface ports active at the same time, allowing multiple users simultaneous access. Output from the ports gets jogged to either side of the output tray so that users can distinguish their print jobs from others' output.

Text output for the SCSI printer wasn't any faster through the SCSI port than the parallel port. This suggests that the real advantage of the SCSI printer comes into play when it's printing large graphics files or moving lots of data from the CPU to the printer. Printing through the parallel port yielded a graphics speed of 2.8 gppm, a full 1.6 gppm slower than the results using the SCSI port.

NCR supplies a device driver to support I/O for applications which normally want to communicate through the parallel port. The driver deals with the logical addressing the SCSI bus uses to communicate with the printer. But this device driver must be specific to the SCSI host adapter to which you connect the SCSI printer. Unfortunately, at this time, NCR only had the device driver available for the MCA SCSI adapter in the NCR PC486/MC-25. NCR plans to develop drivers for the popular SCSI adapters available for both MCA and ISA systems.

With a high-speed engine and multiple active ports, the 6436 is suitable for workgroup applications. With the addition of the SCSI port, it handles large graphics files with aplomb. When NCR writes drivers for the popular SCSI interfaces, go out and find yourself one of these speed demons. It will make waiting for print jobs nothing more than an unpleasant memory. ■

List Price: NCR 6436-0301 SCSI Laser Printer, $7,995; upgrade to 4MB RAM, $995; optional A4, legal or letter tray, $35. NCR Peripheral Products Division, 3718 N. Rock Rd., Wichita, KS 67226; (316) 636-8570.

CIRCLE 700 ON READER SERVICE CARD

Bernoulli's Shockproof Storage To Go

HANDS ON
by Michael Colvin

Bernoulli hard disk technology relies on a clever design: Flexible, removable storage disks are bent around the read/write heads in the hard drive. Traditionally, Bernoulli boxes became dedicated add-ons to a system. Now, this rather expensive, but ingenious technology takes a step toward portability.

The $1,399 Bernoulli Transportable from Iomega Corp. is housed in a rugged plastic case made to withstand all the bumps and bruises of transit. At 12.38 pounds, and measuring 9.5 by 2.75 by 11 inches (HWD), the Transportable is bulky enough that you probably won't want to transport it very far. But the Transportable is a good alternative to sneaker-netting mammoth files from station to station.

The Transportable uses a SCSI interface. Since one of Iomega's visions for the Transportable is as an office-wide backup device, the company includes one SCSI interface board in each package, but sells additional boards for $265 each. Iomega recently introduced a parallel port interface kit for $199, but backing up through the parallel port takes longer.

One thing you don't need to worry about is sturdiness. This unit is *tough*. Our informal tests proved that the Transportable and its media can take a licking. We don't recommend Timex-style abuse, but we dropped the 44MB cartridge from a height of eight feet onto a hard tile floor—and recovered the files without a problem.

Iomega rates the mean time before failure at 60,000 hours and estimates the service life at five years. The Transportable comes with a one-year warranty; disks are covered for five years.

The PC Labs DOS Disk Access and DOS File Access tests were run on a Transportable connected via the SCSI card to a Compaq Deskpro 286. In comparison to tests we ran two years ago on a Bernoulli Box II (see "Removable Mass Storage," September 13, 1988), the Transportable is faster. It completed the DOS Disk Access and DOS File Access (Small Records) tests in 45.09 and 157.20 seconds respectively, compared to 69.06 and 191.85 scores for the Bernoulli Box II. On the Large Records test, however, the Transportable showed slightly slower time than the Box II.

The Transportable is slower than the Compaq hard disk we used for testing. One way we improved its speed was to install its bundled disk caching software, which is based on Multisoft's *PC-Kwik* cache. Also included are Iomega's own RCD utilities for archiving, compression, and formatting, a specially prepared version of Gazelle Systems *Back-It*, and SitBack Technologies' *SitBack* for automated backup.

Bernoulli's disk technology goes portable.

Although high price is a factor, Bernoulli technology generally costs less than optical disk storage. Its random access capabilities give it an advantage over less-expensive tape backup solutions. While not as cheap as tape backup, it offers Rambo-like durability and reliable data backup. ■

List Price: Bernoulli Transportable, $1,399. Iomega Corp., 1821 W. 4000 South, Roy, UT 84067; (800) 456-5522, (801) 778-1000. **In Short:** Portable Bernoulli storage offers traditional reliability and the convenience of on-the-go data backup. Somewhat slower than a hard disk, the device's random access capability nevertheless offers great convenience.

CIRCLE 432 ON READER SERVICE CARD

In Atlanta, Georgia...

You'll find magnolia trees, mockingbirds and Olympics fervor as the city gears up for hosting the 1996 games. In Marietta, a suburb of Atlanta, you'll find ZSoft Corporation and Gateway 2000 computers.

ZSoft, the well-known graphics software company that created PC Paintbrush™, often

ZSoft employees Dave Steier, left, and Don Womick, Jr., with Don's Gateway 2000 20 MHz 386 system.

demonstrates its software at trade shows on Gateway 2000 computers. Dave Steier, ZSoft code librarian and software demonstrator, said he prefers showing products on Gateway systems. "They're terrific," Dave remarked. "I just got back from a show where I was using Gateway 33's and they're screamers."

Don Womick, Jr., a programmer for ZSoft, bought a Gateway 2000 20 MHz 386 for his personal use because he liked the Gateway systems at work. "With Gateway," said Don, "I was able to get the performance I need at a price I could afford."

Don and Dave both commented on the excellent service they received from Gateway. "I've dealt with lots of Gateway people," Dave commented, "and everyone is uniformly polite, friendly and helpful."

Although the Atlanta skyline looks angular and urban, lush natural greenery and friendly people make the city unusually warm and appealing.

GATEWAY2000

*PC Paintbrush™ is a trademark of ZSoft Corporation.

And at the Grand Canyon in Arizona...

You'll find indescribable beauty and serenity or exhilaration if you see the canyon on a tour from Papillon Grand Canyon Helicopters, where Gateway 2000 computers are used in the operation of the canyon's premier flight service.

Rick Carrick, chief pilot, started using PC's a few years ago to run point-of-sale software and to perform weight and balance calculations on aircraft, a critical safety and efficiency procedure. Initially he experimented with several computer firms. "I called Gateway because I liked their ads," Rick admitted. "But I've become a loyal customer because their machines are indestructible and they have excellent customer service."

Rick Carrick, Papillon Grand Canyon Helicopters, and his indestructible Gateway 2000 286.

Rick's first Gateway 2000 system was a 286 model. "This machine runs flawlessly after about a year of continuous operation in a dusty office that's constantly vibrating because of the aircraft outside," commented Rick.

Papillon Helicopters has another Gateway computer now – a 25 MHz 386 – and Rick said he's in the process of replacing all of the company's PC's with Gateway 2000 systems.

Conservationist John Muir said, "...the Grand Canyon will seem as novel to you, as unearthly in the color and grandeur of its architecture as if you had found it after death, on some other star."

GATEWAY2000

waser

In Zurich, Switzerland...

You'll find the famous Swiss watch makers, luscious chocolates, international banks on every corner and Gateway 2000 computers.

Michael Paravicini, a management consultant for Price Waterhouse in Zurich, uses a Gateway 2000 33 MHz 386 system to run project management and business graphics software.

Michael Paravicini, Price Waterhouse, and his Gateway 2000 33 MHz 386 system.

Michael said he heard about Gateway through the PC magazine reviews and ads. "I was impressed by Gateway's price-features comparison," Michael remembered. "My system cost far less than you'd expect to pay for a comparable computer." Continuing, he said, "It was also the responsiveness they showed when I sent a fax request for a quotation. Out of ten U. S. companies I contacted, Gateway was the most prompt and efficient in responding. I still haven't heard from some of the others."

Asked if he had any problems with the system or with purchasing from a U. S. company, Michael said no. "I was satisfied with the entire transaction," he commented. Although many Europeans, like Michael, are comfortable doing business in English, Gateway 2000 also has sales representatives who speak French and Spanish.

Switzerland is celebrating its 700th birthday, which explains why Zurich abounds in classic architecture and old-world charm.

GATEWAY2000

In Lake Elsinore, California...

You'll find rodeos, vineyards, hang gliders, the Palomar Observatory and a remarkable 11-year-old boy called "C.J." with his Gateway 2000 computer.

Of course the Gateway computer, a 386SX, really belongs to C.J.'s parents, Craig and Janet Little. Janet bought the system for her business, Bright Beginnings, a service to welcome newcomers to Lake Elsinore. But, as she explained, "C.J. took over the computer." So it was C.J. who called for help when he got a BIOS error message. Gateway's tech support rep diagnosed the hardware problem, sent a replacement part and guided C.J. through the installation over the phone. "It wasn't that hard," said C.J. "The guy I talked to was really helpful."

C.J. Little and his family's Gateway 2000 386SX.

The Littles chose Gateway 2000 on the recommendation of a relative. "My uncle has a degree in computer science," C.J. commented, "and he told us that Gateway was the best value on the market."

But C.J. and Janet agreed that what impresses them the most about Gateway is the service department. Janet said, "I think when people are spending a lot of money on a computer, service is very important. And we were pleased with the way Gateway handled our problem."

Lake Elsinore, known by Indians as "Hot Springs by the Little Sea," is a popular southern California location for hang gliding.

GATEWAY 2000

And in Fayetteville, Arkansas...

You'll find a delightful little city, surrounded by the Arkansas Ozarks, with miles and miles of rolling green hills, clear lakes and rustic farms. You'll also find a large farmers' market in the town square, Betty's Word Processing and Gateway 2000 computers.

Betty and Bill Carson, owners of Betty's Word Processing, and their Gateway 2000 386SX.

Betty Carson and her husband Bill own and operate Betty's Word Processing. The couple uses a Gateway 2000 386SX to run word processing, spread sheet and genealogy software. (Betty has traced her family back to 1649!) Betty and Bill picked Gateway 2000 after a lot of study.

"Bill reads all the computer magazines," Betty remarked, "and he's convinced Gateway has the best quality hardware around – and a great price."

"We've used several different computers," added Bill, whose hobby is electronics, "including an Apple and an IBM. But we like our Gateway the best."

Betty said she was most appreciative of Gateway's technical service people. "They don't talk down to you," she commented. "They're always patient and helpful."

Fayetteville, population 42,000, is centered around an historic town square.

GATEWAY2000

People the World Over

Everywhere you look these days you'll find Gateway 2000 computers. That's because people everywhere know a good value when they see one. In all 50 states and in over 70 foreign countries, thousands of people are comparing price, quality and service – and choosing Gateway 2000. Compare for yourself.

Price

Examine the last page of this ad, where you'll find a concise listing of Gateway 2000's product line, and compare Gateway's features and prices with any other computer manufacturer. Many competitors try to trick you with low prices on stripped-down systems. Others copy Gateway's features and prices but don't tell you they're using fishy components and building their systems in the back of their brother-in-law's bait shop. When you've had enough of the confusion, call Gateway for some straight talk from a knowledgeable sales person. In a direct comparison, Gateway has the best prices.

Quality

Don't let Gateway's low prices deceive you about quality. Only the highest quality components go into a Gateway 2000 computer. Each system is custom-built with pride by one of Gateway's Midwest technicians. As the reviews indicate, the quality of a Gateway 2000 system is comparable to the best PC's on the market.

"The combination of price, quality and service makes Gateway 2000 the best value in the industry."

"They're terrific. I just got back from a show where I was using Gateway's 33's and they're screamers." Dave Steier

"Bill reads all the computer magazines and he's convinced Gateway has the best quality hardware around." Betty Carson

Service

Of all the factors to consider when selecting a computer, service is perhaps the most important and the most difficult to judge. When customers talk about Gateway 2000, they invariably mention service.

"What impressed me most about Gateway was the service. The guy I talked to was really helpful." C. J. Little

"Everyone is uniformly polite, friendly and helpful." Dave Steier

PC Magazine's September 25 issue included the results of a survey about service and reliability that confirm what these Gateway 2000 customers are saying:

Choose Gateway 2000!

"Gateway shared top billing with such heavyweights as Compaq, IBM, and HP for those who would buy their products again...Overall, Gateway's high marks bode well for the company's future, as does its commitment to customer service."

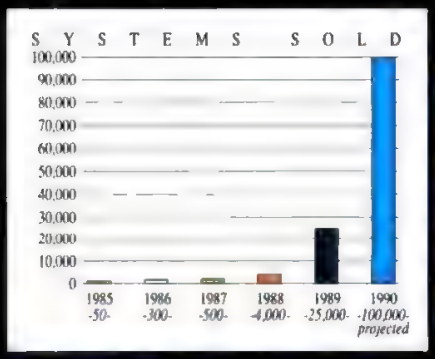
PC Magazine
September 25, 1990

"In the computer industry, longevity should be measured in dog years."

Success

The combination of price, quality and service makes Gateway 2000 the best value in the industry. But value alone doesn't explain how a little company in the Midwest, just celebrating its fifth anniversary, managed to outdistance hundreds of other companies, selling more systems through the direct market channel than any other PC manufacturer in the country.

"It was the cows," laughed Ted Waitt, Gateway 2000 President and CEO. "Of course." Computer magazine readers will remember that the company's early ads featured a picture of the Waitt family cattle farm with the headline, "Computers from Iowa?"



Gateway 2000 sells more computers through the direct market channel than any other PC manufacturer in the country.

"We can't run that ad anymore," continued Ted, grinning, "because we built a new plant 14 miles down the road in South Dakota. But the cows really worked for us. They made the phones ring. From then on, though, we built our business on value – good prices on quality systems with old-fashioned, personal service."

Ted mentioned another reason for Gateway's success. "We take a long-term approach to customer service," he said. "When you buy a computer from Gateway 2000, you become part of our family and we're going to be there for you as long as you own that machine."

As Ted talked about the company's fifth anniversary, he laughed again. "In the computer industry, longevity should be measured in dog years," he chuckled, "because everything's moving so fast. That makes Gateway 35 years old! But seriously, we've come a long way in five years. And I owe it all to the great people at Gateway and to our customers."

Dial the Phone

Gateway 2000 will be there for you 'til the cows come home.

When you add it all up, you'll understand why people the world over choose Gateway 2000. So pick up the phone and dial. Whether you're from Washington or Sweden, Connecticut or Canada, you've got a friend in the business at Gateway 2000.

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Folio Views 2.0 Brings New Capabilities to Infobases

HANDS ON
by Henry Fersko-Weiss

Folio Views 2.0 can turn text files into an indexed database, create linked concepts within the database, and add external links to graphics, animation, or audio. It's an idea manager cum hypertext-authoring tool from Folio Corp.

At the heart of *Views* is a conversion utility that works with 41 native file formats. The conversion process creates an "infobase" of up to 1,000 text files pasted together to accumulate up to two gigabytes of information. An infobase can also be built using *Views*' text editor.

Views creates an index to every word—*literally* every word, even "the," "a," and "and," but *Views*' compression scheme can halve the size of these large indexed files.

During the conversion process, *Views* divides an infobase into idea-sized chunks called folios. Folios can break at paragraphs, pages, or files, but you can also customize folio breaks anywhere in the text file.

Building an infobase is fairly quick, but exceptionally large infobases might take hours to build. An 18K file took 57 seconds with the folio per paragraph option.

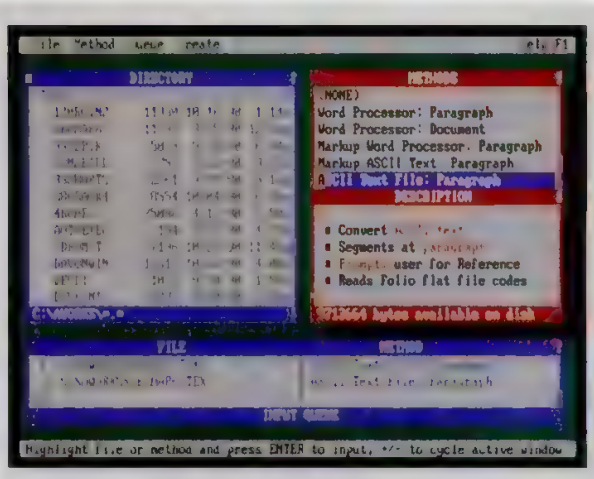
Once you've created an infobase, the real benefits begin to surface. Its search utility utilizes three windows: one for words, which shows a list of all the words in an infobase; one for results, which shows you the search "hits"; and one where you build the search query. Query words are typed directly or selected from a pick-list window. Wildcards and/or Boolean connectors are permitted.

Searching can be the first step to creating "groups"—relationships between folios by topic. Tag commands allow you to mark, name, and search the group.

Views can create hypertext links. Links, which appear as inverted triangles on-screen, can help navigate a search query, folio, view (one screen of a folio), tag, or group. Linking is useful for creating menus to your infobase, tables of contents, or active footnotes.

In addition to text links within or between infobases, you can hotlink to other programs. *Views* will automatically display the images from other programs, provided they are in a .PCX file format. You can also link to a spreadsheet, word processing document, or animation sequence. And *Views* has built-in support for audio files in the RealSound format.

Infobases can be read using a runtime version of the program. Building infobases takes time—you have to be willing to adjust folios, build groups, and embed links. But ideas acquire more value as you connect them together, and *Views* lets you do this creatively. ■



Views takes files from any of 41 file formats and converts them into "infobases"—idea-sized chunks called folios.

List Price: *Folio Views* 2.0 single-user version, $495; network version, $695 and $395 for each additional station; Professional Edition unlimited runtime license, $695.
Requires: 512K RAM, DOS 3.0 or later. Folio Corp., 2155 N. Freedom Blvd., #150, Provo, UT 84604; (800) 543-6546, (801) 375-3700.

CIRCLE 703 ON READER SERVICE CARD

$47 PKlite Compresses .COM and .EXE, Leaves Them Executable

HANDS ON
by Nick Anis

As the number and size of application programs grows, disk space comes increasingly at a premium. One space-saving solution is PKware's $47 file compression program, *PKlite*. The program compresses .COM and .EXE files but leaves them executable. Not only don't you need to extract the files, but they'll also run without *PKlite*'s being present. It does not compress files other than .EXE and .COM files, but the compression algorithm it uses is based on its predecessor, *PKZIP*'s imploding algorithm.

PKlite is a minuscule program, occupying less than 14K, and operates from the DOS command line.

To run it, you simply enter the PKLITE command at the prompt line, followed by the file you want to compress. The program automatically skips over files that aren't .COM or .EXE and also bypasses files that won't benefit from the compression process. If no options, arguments, or filenames have been specified, a full-page help screen is displayed. For example, there are arguments that let you use DOS wildcards to process groups of files.

A single pass through your drive with *PKlite* will reduce the size of executable files with tight file compression—compression that can, on some files, surpass the results of *PKZIP* and *LHARC*. The execution speed of compressed programs remains unaffected, but the program loading may take from 2 to 5 seconds longer.

PKlite has several safety features, including an option to create an uncompressed backup copy and another option to expand files back into their original form. These features can help you resurrect a file if compressing it causes any problems.

PKlite will also detect and bypass most programs that shouldn't be modified, for example, .EXE files that relocate stacks, or programs that are altered while running. It can miss detecting some programs that are self-modifying, though.

I ran *PKlite* on my catch-all utility directory containing several hundred files. I also ran it on commercial applications including *The Norton Utilities*, *Mace Utilities*, *WordPerfect*, *WordStar*, and *Lotus 1-2-3* and had trouble only with a few files. Uncompressed, the *WordPerfect* 5.1 executable is 220,627 bytes. The *PKlite* version of the executable is 162,900 bytes. Some of my programs wouldn't run after being compressed, but once I converted these programs back to their original format they ran fine.

It's been said that you can't squeeze blood from a stone, but for $47, *PKlite* does a pretty good job of squeezing the most from your hard disk. ■

List Price: *PKlite*, $47.
Requires: 256K RAM, DOS 2.0 or later. PKWARE Inc. 7545 N. Port Washington Rd., Glendale, WI 53217; (414) 352-3670.

CIRCLE 433 ON READER SERVICE CARD

Outside In: A TSR for Smart Data Import

HANDSON by Ed Perratore

Outside In 1.0, from Systems Compatibility Corp., is a TSR that lets you import data from most popular word processing, spreadsheet, and database packages into your own word processor—with a variety of formatting options. Priced at $99, the product also comes in a five-user LAN version for $299. Its 72K RAM requirements (50K using EMS) are not trivial, but because the program can mix and match so many file formats, it may be worth the space.

Outside In recognizes file formats from more than 50 programs, and comes with ready-to-use settings for 27 destination word processors. If yours isn't there, fear not. You can define as many additional applications as you need—several, even, for one word processor—or modify the existing ones. The latter option comes in handy if you sometimes perform import tasks (such as comma-delimited data for mail merge) that require different settings from those you normally use.

Pressing Ctrl-I from within your word processor brings up *Outside In*. On the left side of the display, you'll notice a file listing of either the default directory or one you select. Scroll down the list and you'll see, in *Outside In's* document viewing window, the contents of any file in a supported format.

If you need a better look at the file, pressing F2 zooms the display to cover the file-listing window. You can enlarge your view further by toggling off the function-key template on the bottom of the screen. Once you've displayed the file you wish to import, the Tab key toggles you into the document viewing window.

Outside In offers a number of options for selecting data. First, you can highlight the whole file. Hitting the Ins key copies the data into your word processor and plops it into a spot you chose earlier. If you're importing spreadsheet data, you can define horizontal and vertical ranges (noncontiguous if you like) and bring in the intersecting cells. Other highlighting options include line, user-defined block, and text string.

The program translates only a word processor's most elementary formatting codes into those of your own. But if you want, say, underlined text from your source file to appear in a different font in your word processor, you can tell *Outside In* to issue the command to switch fonts in the target document instead of the command that your word processor normally uses to underline.

There are plenty more ways to customize *Outside In*. A paragraph, for instance, can be imported "as is" or stripped of carriage returns—quite the godsend for e-mail users. You'll probably need to practice with spreadsheet or database files (and set your word processor appropriately) to ensure that imported columns or fields align properly.

One missing feature is a way to save an application's setup file under a new name for those times when you want most, but not all, of your program's usual settings for a particular task. *Outside In* also requires some time investment to configure it properly for your own needs. Once set up, however, the program's smooth operation and helpful documentation may make you forget you ever had problems with format incompatibilities. ■

List Price: *Outside In*, Version 1.0, $99; network version: $299 for five workstations, $49 each additional workstation.
Requires: 72K RAM (50K conventional RAM with EMS), DOS 2.0 or later. Systems Compatibility Corp., 401 North Wabash, #600, Chicago, IL 60611; (312) 329-0700.

CIRCLE 445 ON READER SERVICE CARD

MLAB: Quick and Easy Data Analysis for Scientists

HANDSON by Barry Simon

MLAB (the "M" stands for modeling) has something in common with other mathematical models such as *Mathematica*, but what sets it apart from the others is its painless way of matching data to models while fitting parameters. This $3,000 program from Civilized Software will be especially interesting for researchers in the biological, social, and experimental physical sciences, as well as some engineers.

MLAB's simple operation lets you enter one or more equations containing variables and unknown parameters. You specify sets of data for the variables, either from an ASCII file or by direct manual input. You then enter the command FIT and sit back as *MLAB* finds the best values of the parameters to fit the data—the default is to use a least square fit algorithm. The program then makes a simple text report of the values of the parameters, although you can then graph the results, provided the equation has only one independent variable.

While many packages are capable of handling linear regressions, they are restricted to creating models that have linear dependence on the variables. Unlike most competing products, *MLAB* handles nonlinear equations. A few other PC packages, such as the $249 *MINSQ* (Micromath, P.O. Box 21550, Salt Lake City, UT 84121; 800-942-6284), also have general nonlinear parameter fitting, but only *MLAB* can fit models with differential or finite difference equations.

For any given problem, you could probably duplicate *MLAB*'s ability with programs such as *Gauss* or *Mathematica*, but you'd need to rely on numerical analysis and serious programming. In contrast, *MLAB* is automated. *MLAB*'s programming statements are few. For example, there are straightforward if-then and for programming constructs. In addition, *MLAB* supplements its critical functionality with the largest array of special functions I have ever seen in a math toolbox including scientific (e.g. Bessel, elliptic, and ERF), probabilistic (e.g. chi squared), statistical (e.g. kurtosis), signal processing, and cluster analysis.

Graphics are limited to two dimensions but include graphs such as contour projections of surface areas. The program supports output from HP LaserJets and PostScript printers.

The interface is rather poor; it uses a look and feel once common in the mainframe world, where *MLAB* has its origins. Under normal circumstances, the only editing key is the backspace, although you can shift into a built-in line editor. Here, you can access the last command you enter, but that's all. Anything that scrolls off the screen is gone forever.

MLAB is copy protected using a parallel port dongle. It does not get along well with TSRs, and the manual warns that it does not work with many networks.

In a world where *Mathematica*, *Gauss*, and *Maple* are each available for under $1,000, *MLAB*'s price seems excessive, especially when you consider its poor interface, lack of *Lotus 1-2-3* import, and its copy protection. Yet despite these shortcomings, if you need to do a best fit of data where you have unknown parameters, *MLAB* is likely to become central to your work. ■

List Price: *MLAB*, $3,000.
Requires: 80286 or higher CPU, 640K RAM, Intel math coprocessor, DOS 3.3 or later. Copy protected with parallel port block. Civilized Software Inc., 7735 Old Georgetown Rd., #410, Bethesda, MD 20814; (301) 652-4714.

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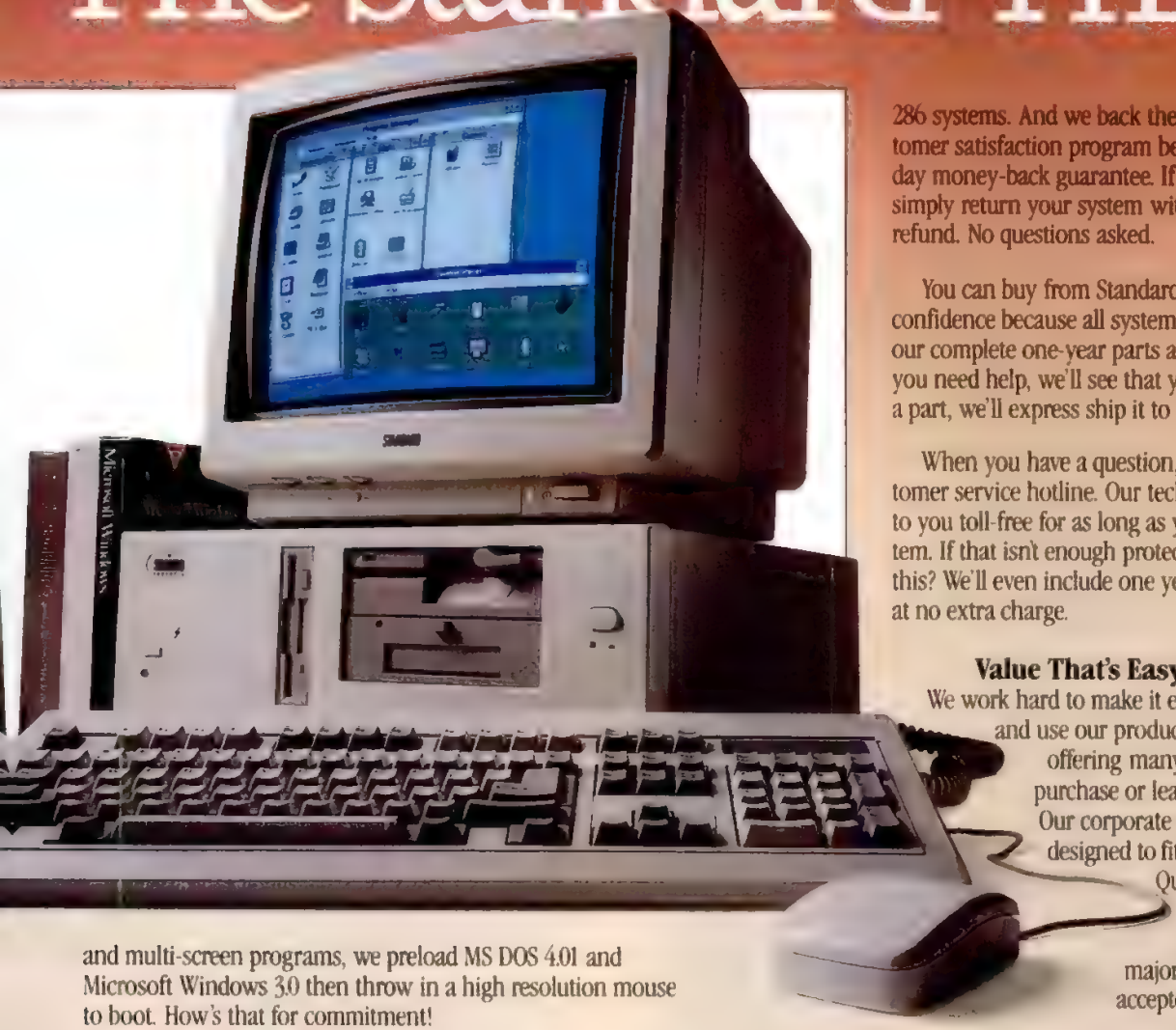

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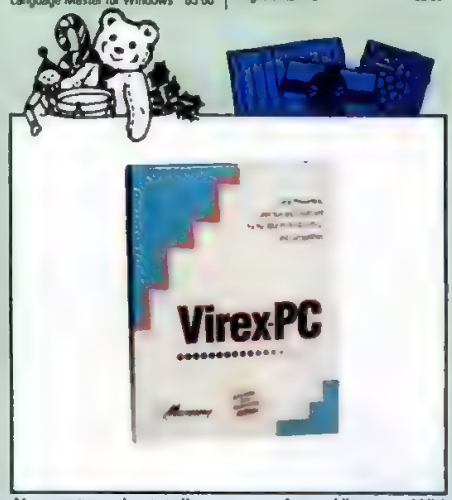

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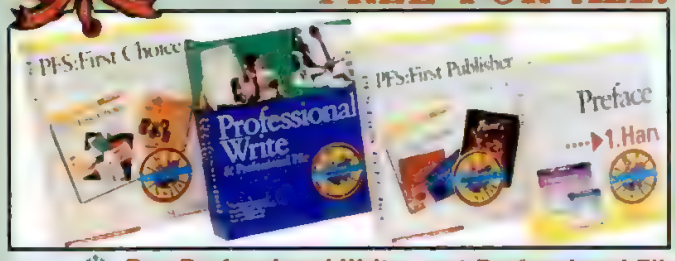

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News of Announced Products and Upgrades

Sixteen Pages-Per-Minute PostScript From TI

NEW

Texas Instruments' microLaser XL series of small footprint upgradable PostScript printers promise an output of up to 16 pages per minute. Measuring 10.8 by 15.8 by 16.6 inches (HWD), the microLaser XL ships in three models: the standard XL with HP LaserJet Series II emulation and 500K RAM; the XL PS17 with the Adobe PostScript interpreter, 17 scalable fonts and 1.5MB RAM; and the XL PS35 with 35 PostScript fonts. Other features include the ability to store up to four user-definable printer configurations, a total RAM capacity up to 4.5 MB, one parallel port (a Serial/AppleTalk port is a $145 option), a 250-sheet internal paper drawer, and the ability to print a variety of paper types such as letter, legal, half-letter, transparencies, and labels.

The microLaser XL also includes a 16-character LCD which displays words or abbreviations rather than codes to let users select fonts, paper drawers, and page orientation. An optional 500-sheet paper tray will expand print capacity to 750 pages without refilling. Since the optional PostScript boards piggyback onto the XL controller board, the standard XL model can be upgraded to PostScript in the field. Texas Instruments claims that the microLaser XL will handle 25,000 pages per month, and the printer ships with a one-year warranty.

To keep a compact footprint, the microLaser XL's paper tray fits inside the printer.

List Price: microLaser XL, $3,499; XL PS17, $4,049; XL PS35, $4,549; the 1MB 17-font PostScript upgrade board, $550; 35 fonts, $1,050. Texas Instruments Inc., Information Technology Group, P.O. Box 202230, ITG-067, Austin, TX 78720-2230; (800) 527-3500.

CIRCLE 435 ON READER SERVICE CARD

Upgradable Micro Channel from ALR

NEW

Advanced Logic Research introduces the Modular Processor System (MPS), an upgradable Micro Channel 386. Starting at $1,995 for a 33-MHz 386 featuring a 16K Smart Cache and 32-bit bus-mastering capabilities, the system is upgradable to a 25- or 33-MHz 486. The base configuration includes 1MB RAM, with memory expandable to 49MB, one high-density 3.5-inch floppy disk drive (the system supports a total of four 3.5-inch storage devices), a 150-watt power supply, eight expansion slots including four 16-bit MCA, two 32-bit MCA, and two proprietary slots for CPU and memory expansion. The ALR Micro Channel-compatible VGA adapter is a required option that will add $300 to the quoted price. The system measures 6 by 15 by 17 inches (HWD), weighs 35 pounds, and ships standard with a one-year warranty.

List Price: ALR Modular Processor System (MPS) 386/33 with 1MB RAM, high-density 3.5 inch floppy disk drive, VGA video adapter, $2,295; with 16K static cache RAM, 40MB hard drive, $3,295. Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; (714) 581-6770.

CIRCLE 436 ON READER SERVICE CARD

HOT PROSPECT

The Kodak Diconix Color 4 printer's new ink promises not to smear.

PORTABLE COLOR PRINTER FROM EASTMAN KODAK

Eastman Kodak has unveiled a small footprint, color ink jet printer for $1,495. Weighing 13 pounds, and measuring 4 by 20 by 13.7 inches (HWD), the Diconix Color 4 printer produces color text and graphics at resolutions up to 192 by 192 dots per inch, and it can print at speeds as high as 150 characters per second. Users have the choice of three printing modes (draft, near letter quality, and quality) and three built-in fonts. Eliminating the need for special thermal paper, the Diconix can print on plain paper or ink jet transparencies. It can handle continuous-form tractor feed paper or up to 60 cut-sheet pages from a built-in paper tray. To ensure print quality, the Diconix uses a separate printhead for each color—cyan, magenta, yellow, and black—which work in tandem to produce a full palette of colors. The ink is not water-based, so it won't smear when wet, and each ink cartridge promises 500 pages worth of text and graphics.

List Price: Kodak Diconix Color 4 printer, $1,495. Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14653-6305; (800) 344-0006.

CIRCLE 444 ON READER SERVICE CARD

Training Wheels For Windows

NEW

The *Microsoft Productivity Pack* is designed to help users work better with *Windows* 3.0. The package offers three modules: Learning Windows, Working Smarter, and Quick Troubleshooter.

The Learning Windows module is an interactive tutorial offering lessons in several categories including: Getting Started, Windows Essentials, Working with Applications, File Management, and Program Manager.

Working Smarter provides 45 tips on how to do things faster and easier. The program teaches users how to switch efficiently between applications, create a RAM drive, and more.

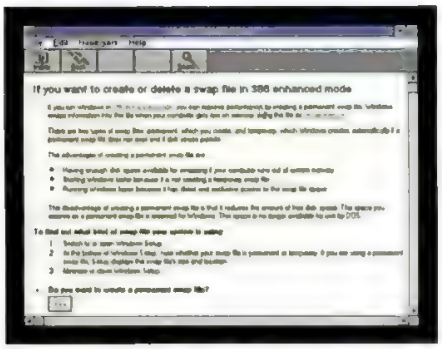
The Quick Troubleshooter is designed to

CONTINUES ON PAGE 56

New&Improved

CONTINUED FROM PAGE 55

simulate a technical support call by walking the user through the problems. Users learn basic problem solving like what to do if their printer won't print, or more-advanced problem solving such as how to create or delete a swapfile in 386 enhanced mode. The information in the Troubleshooter is cross-referenced



The Troubleshooter within the *Microsoft Productivity Pack* shows how to create a swap file in 386 enhanced mode.

so the user can go as deeply into the information as he or she wants to.

Microsoft has also begun shipping *The Microsoft Office for Windows*. This package combines three of the company's business applications for *Windows* 3.0. Included in the package are *Microsoft Excel* (spreadsheet), *Word for Windows* (word processor), and *Microsoft PowerPoint* (presentation graphics program). *The Microsoft Office* contains disks and documentation for all three products, and a new manual designed to instruct users on how to use the applications together most effectively. The suggested retail price for *The Microsoft Office for Windows* is $995.
List Price: *Microsoft Productivity Pack*, $59.95. **Requires:** 1MB RAM, DOS 3.1 or later, *Windows* 3.0 or later. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (206) 882-8080.

CIRCLE 437 ON READER SERVICE CARD

DOS Window For Unix

NEW

For SPARCstation users who need access to DOS applications, **Insignia Solutions** has announced a program that emulates an IBM PC AT. *SoftPC* enables users to run multiple DOS sessions on a single SPARCstation. The program runs under SunOS and takes advantage of SunOS features while also providing all the features of DOS 3.3. A freeze feature lets a Sun workstation user place the SunOS application on hold, then run a DOS application. *SoftPC*'s file-sharing architecture handles text file conversions between SunOS and DOS, thus making any Unix directory appear in the MS-DOS environment. Multiple *SoftPC* windows can run concurrently, and *SoftPC* supports LIM memory expansion, allowing users to access up to 4MB of memory.
List Price: *SoftPC* for single user, $695.
Requires: SPARCstation or Sun/4, 8MB RAM, color EGA or VGA, Sun OS 4.1, 10MB disk space. Insignia Solutions Inc., 6 Campanelli Dr., Andover, MA 01810; (508) 682-7600.

CIRCLE 438 ON READER SERVICE CARD

Six New V.42bis Modems from GVC

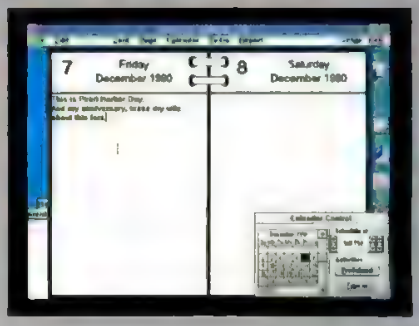
NEW

GVC Technologies announces six modems that incorporate the latest V.42bis data compression at an affordable price. The SM-96 is a $699 external desktop V.32/V.42 9,600-bps modem with V.42bis data compression and

CONTINUES ON PAGE 58

IMPROVED

***YourWay*, Version 1.1**—Prisma Software has lowered the price of and announces new features to its *Windows*-based personal information manager (PIM). The Recurring Events feature allows users to schedule regularly occurring events into the calendar with a click of the mouse. Version 1.1 also lets users view multiple card files on-screen, link card files, click and drag card files to move or copy information into another card file. Automatic hypertext provides links between the calendar, the to-do clipboard, and specific cards. Other improvements include card files that can be reindexed, export of card files to .DBF, .DIF, and text file formats; and the clock on the calendar can be set in 15-minute increments, as well as by individual minutes. The reduced retail price for *YourWay* is $199 with upgrades available free from Prisma Software Corp. in Cedar Falls, Iowa at (319) 266-7141.



***YourWay*, Version 1.1 features hypertext links.**

cc:Mail for Windows—cc:Mail's network e-mail package now works under *Microsoft Windows* 3.0. Based on the company's third-generation messaging architecture, *cc:Mail for Windows* conforms to the IBM SAA/CUA and *Microsoft Windows* standards, and takes advantage of the Multiple Document Interface (MDI) provided in *Windows* 3.0. Through MDI, *cc:Mail for Windows* gives users the ability to open multiple messages, folders, mailing lists, and interchange objects among them. This scheme is designed to let users compose a message in one window, refer to a fax item in the In-box, and view a message stored in another folder. *cc:Mail for Windows* is object-oriented and permits users to point and drag any object from one window to another. *cc:Mail for Windows* also features a modeless operation so that users may move partially completed messages into another message folder or bulletin board without having to complete, close, or discard the message in progress. Icons include Prepare, In-box, Mailing List, Trash, Send, Reply, Forward, and Attach. When users receive an attached document, *cc:Mail* 's filter permits users to view the files in native format. This means if a user receives an attached *Microsoft Excel* file but does not have the *Excel* program, he or she can still view the file. *cc:Mail for Windows* also features icon menus for easy selection with a mouse. *cc:Mail for Windows* is part of the company's strategy to expand in the multiplatform, multimedia network workplace. The company's e-mail system runs on all major LANs and workstation platforms and provides gateways to other major e-mail systems and to Group 3 facsimile machines. *cc:Mail for Windows* retails for $695 for 25 users, from cc:Mail Inc. in Mountain View, Calif. at (415) 961-8800.

***DOS Systat*, Version 5.0**—The statistical analysis, data management, and graphics software utility from Systat now integrates graphics and analysis procedures through a new pull-down hierarchical menu system. Version 5.0 features context-sensitive help, a spinning procedure that enables users to visualize data in 3-D space, and several new graphs including: spherical mapping, dot plots which display densities, arrow or vector plots for fluid flow and other problems, and weather vane plots. Other features in Version 5.0 include device drivers for many common output devices, as well as superscripts, subscripts, overstrikes, and embedded font changes for scientific and specialized typesetting. Statistical improvements

CONTINUES ON PAGE 58

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CONTINUED FROM PAGE 56

MNP Level 5 error correction. The internal half-card SM-96H has the same features as the SM-96 but lists for $629. The $299 FM-9624 (desktop) and the $259 FM-9624H (internal) fax modems feature a 9,600-bps send/receive fax and 2,400-bps data modem. For laptop users, the $271 MM-24V pocket-sized modem features V.42bis and MNP Level 5 at speeds up to 9,600 bps. The SM-96S is an $899 desktop modem that features extended leased line support, allowing communication over 2- and 4-wire leased lines. The SM-96S features phone jacks for dial-up, leased line, and telephone connections.

List Price: SM-96, $699; SM-96H, $629; FM-9624, $299; FM-9624H, $259; MM-24V, $271; SM-96S, $899. GVC Technologies Inc., 99 Demarest Rd., Sparta, NJ 07871; (201) 579-3630.

CIRCLE 439 ON READER SERVICE CARD

IMPROVED

CONTINUED FROM PAGE 56

include enhancements to model estimation and hypothesis testing with support of the means model. Systat says this model is helpful for designs that have missing cells, or have cells with unequal *n* values. Stepwise regression output now has options for forward, backward, and interactive stepping. New post-hoc methods include Scheffe, Dunnett one- and two-sided, Bonferroni, Fisher's LSD, and Tukey-Kramer. Other additions include descriptive statistics, frequency distributions, t-tests, cluster analysis, variance analysis, multidimensional scaling, nonparametric statistics, repeated measures, correlations, simple linear and multiple linear regression, forecasting and exponential smoothing, common factor analysis, and nonlinear regression. *DOS Systat*, Version 5.0, retails for $895, with upgrades available for $195 from Systat Inc. in Evanston, Ill. at (708) 864-5670.

***Realia COBOL*, Version 4.0**—Designed for users who don't want to rule out OS/2, but still don't want to commit to it, Realia has introduced a new version of its optimizing COBOL compiler for DOS or OS/2. Since *Realia COBOL* 4.0 ships bundled with DOS/16M (Rational Systems' DOS extender), users can write applications that will run under DOS, extended DOS, and OS/2. Version 4.0 also supports the OS/2 Dynamic Link Library (DLL) function under DOS or extended DOS, thereby allowing programs to resolve external references at runtime instead of link time. Version 4.0 includes function prototyping, a feature designed to simplify the communication between COBOL programs to non-COBOL systems, and to API-based interfaces such as OS/2 Presentation Manager. Version 4.0 emulates several dialects including IBM VS COBOL II, SAA, and IBM's ANSI-68-compatible ANS COBOL. Other features include an improved linker, an object library management system, an interface to Microsoft C and any other language that uses similar linking conventions, EBCDIC file and collating sequence support, a record-oriented data file editor, a source-level debugger, and a full-screen program editor. *Realia COBOL*, Version 4.0, retails for $995, and free upgrades will be shipped automatically. Realia Inc. is located in Chicago, Ill. at (312) 346-0642.

***FlexGen*, Version 2.1**—SINC's COBOL development tool for the NCR System 3000, which automatically generates code according to the features the user desires, now runs under DOS, Unix, and Xenix. In its latest incarnation, *FlexGen* also includes: an interactive guide for

CONTINUES ON PAGE 60

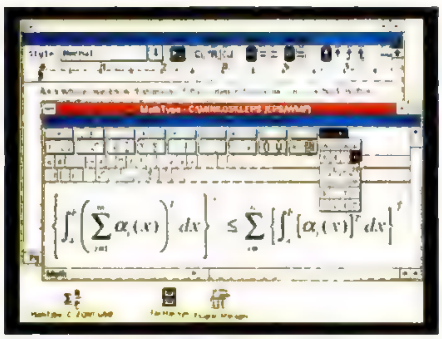
WYSIWYG Math Processing

NEW

Design Science has introduced a PC version of its mathematical equation editor. Running under *Microsoft Windows*, *MathType* allows users to build mathematical equations using standard point and click techniques. For each basic mathematical construct (such as fractions or integrals), *MathType* provides a template consisting of symbols and empty slots. Users select on-screen icons and fill in the slots to build equations. *MathType* provides 120 templates and over 150 mathematical symbols. Users can save up to 32 macros, select fonts, and can adjust size, spacing, and position of characters. Equations may be transferred to the *Windows* clipboard or saved as an Encapsulated PostScript (EPS) file with TIFF or *Windows* Graphics Metafile (WMF) screen graphics, or as an Aldus Placeable Metafile. *MathType* supports Dynamic Data Exchange (DDE), and includes macros designed to form a seamless interface with WYSIWYG word processors such as *Word for Windows* and *Ami Professional*. Design Science also promises that *MathType* will work with any *Windows*-based word processing/page layout program, and with programs that accept .EPS files, such as *WordPerfect* 5.0, *Microsoft Word* 5.0, Xerox *Ventura Publisher*, and *IBM Interleaf Publisher*.

List Price: *MathType for Windows*, $249. **Requires:** 640K RAM, *Microsoft Windows* 2.10 or later. Design Science Inc., 6475-B E. Pacific Coast Hwy., #392, Long Beach, CA 90803; (213) 433-0685.

CIRCLE 440 ON READER SERVICE CARD



***Mathtype* works with your word processor to add equations to a document.**

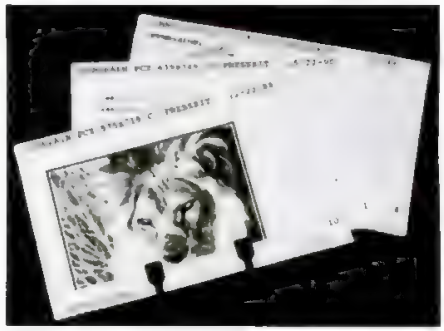
Utility Gets a Grip on Your Graphics

NEW

Operating on the theory that a Rolodex is sometimes faster than a computer, **Market Street Software** announces *Grip*, a graphics management utility that allows users to create 3- by 5-inch image card files. But that's only one feature within *Grip*'s grasp. *Grip* also allows users to capture screens to the .PCX format, view graphics images on-line, and, as claimed by the manufacturer, to print each image in less than 10 seconds. Users can print in four sizes: thumbnail—fifteen per page; four per page (with ID information included); one per page; or to Grip-dex (three Rolodex-sized images per page). Users may also manipulate color and images, as well as print images as binary files or with an Image Index of specific graphics information such as standard DOS information, image mode, and resolution. *Grip* retails for $89.95.

List Price: *Grip*, $89.95. **Requires:** 400K RAM, HP LaserJet or compatible printer, DOS 3.0 or later. Market Street Software, 611 Market St., Kirkland, WA 98033; (206) 889-2400.

CIRCLE 441 ON READER SERVICE CARD



***Grip*'s 3-by 5-inch output.**

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New Program Brings Graphics To Accounting

NEW

Evolve, a new *Windows*-based financial analysis tool from **Absolute Solutions** brings graphical power to any accounting package. *Evolve* promises to transform data from your accounting package into flexible financial statements, business ratios, budgets, cash flow reports, charts, and graphs. Integrated with *Microsoft Excel*, *Evolve* operates in the *Windows* 3.0 environment, transforming the data into the *Evolve* format. Users can accumulate accounting data from one month up to five years, then view it, display it, prepare financial statements for auditors, or even output to tax programs such as Softview's *Taxview*.
List Price: *Evolve*, $195. **Requires:** *Microsoft Windows* 3.0, *Microsoft Excel*, DOS 3.0 or later. Absolute Solutions, 3142 Vista Way, #400, Oceanside, CA 92056; (800) 633-7666 or (619) 966-8000.

CIRCLE 442 ON READER SERVICE CARD

New PIM for Project Managers

NEW

Time/Design's personal information manager is geared toward professionals managing projects, people, and plans. Based on Chronos Software's *Who-What-When* software, *TimeBase* allows users to schedule, prioritize, and delegate multiple activities, as well as follow-up on a variety of projects. *TimeBase*'s project management features include project tracking, Gantt charts, milestones, resource-leveling, and deadlines.

Other features include a DOS gate allowing users to move directly to other applications; the ability to cross-reference activities and contacts; a telephone/address directory with auto-dialer, mail list manager, and mailing label generator; a memo processor; pop-up calendar; to-do lists; alarm clock; and calculator. Users can print out the 14 included report types.

TimeBasic's information can also be printed to small-format paper for use with Time/Design's paper-based Management System. ■
List Price: *TimeBase*, $195. **Requires:** 512K RAM, DOS 2.1 or later. Time/Design, 11835 W. Olympic Blvd., #450, Los Angeles, CA 90064; (800) 637-9942 or (213) 312-0288.

CIRCLE 443 ON READER SERVICE CARD

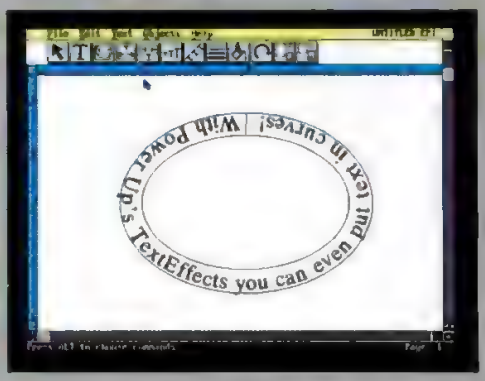
IMPROVED

CONTINUED FROM PAGE 58

query building, an Extract/Update Module, an interchange module that lets users transfer dictionaries and programs between unlike CPUs, an integrated menu processor with security, and an active dictionary featuring cross-referencing. Support has also been added for several COBOL compilers such as Ryan McFarland, Microfocus, MBP, and ACUCOBOL. For pricing information on *FlexGen*, Version 2.1, contact SINC Inc. in Xenia, Ohio at (800) 543-4035 or (513) 372-4334.

***Presentation Task Force*, Version 3.0**—New Vision Technologies now offers more than 1,100 clip-art files. Version 3.0 of the *Presentation Task Force* features a set of images designed for the business professional, and has expanded its compatibility to function with *WordPerfect*, *DrawPerfect*, *Lotus 1-2-3*, *Impress*, *Microsoft PowerPoint*, *Microsoft Word for Windows*, *IBM Display Write*, and *SlideWrite Plus*. *Presentation Task Force*, Version 3.0, retails for $199 with upgrades for $89. Contact New Vision Technologies Inc. in Ottawa, Canada at (613) 727-8184.

***Express Publisher*, Version 2.0**—Power Up Software Corp.'s desktop publishing package now includes TextEffects, a graphics module that allows users to create headlines and logos. The TextEffects lets users manipulate text to fill a polygon, bend along a curve, grow or shrink from one character to the next, or run along an angled line. Also new to Version 2.0 are five additional AGFA Compugraphic Intellifont Scalable Typefaces in sizes from 6 to 144 points. Version 2.0 can create and print documents in landscape. It also allows headers and footers on every page of a document, and the program will update page numbers whenever the user adds or removes pages. Other features include zoom, multiple object selection, .CGM import capability, as well as the ability to import *PFS:Write*, *PFS:Professional Write*, and *IBM Writing Assistant*. *Express Publisher*, Version 2.0, retails for $159.95. Upgrades are $34.95 from Power Up Software Corp. in San Mateo, Calif. at (800) 851-2917 or (415) 345-5900.



***Express Publisher*'s TextEffects lets users manipulate text in many new ways.**

***Analyst One*'s graph let's users view different data over the same graph range.**

***Analyst One*, Version 1.20**—Feldstar's three-dimensional database and spreadsheet analysis package features an improved interface with more pick lists, and an installation procedure that checks for the correct disk. Pick lists are now active in all circumstances where multiple options exist for a choice. Format names and numbers have been increased to eight characters to permit the use of words as the identifier and increase the available number of selections. Mouse support has been increased to all edit and format screens. Version 1.2's Re-Calculate command permits users to modify data between date ranges. Feldstar says this function is particularly useful when an error has been discovered in a data entry formula or if a modification has been made to a global variable, affecting the past data entries. Version 1.2 also features Wave Graphs that permit users to overlay different years' data onto the same graph range. Wave Graphs are Line Graphs with definable time periods. This allows you to examine each year on the same graph superimposed upon each other. After installation, Version 1.2 can handle changes to installations parameters such as selected display adapter, printer driver, landscape, black/white reversal, printer port, and scaling. *Analyst One* retails for $199 with free upgrades from Feldstar Software Inc. in Dallas, Tex. at (214) 407-1006.

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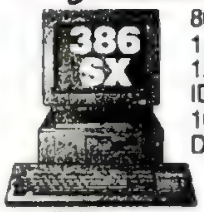

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1.2MB 5¼" Drive
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DOS 4.01

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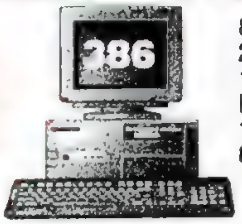

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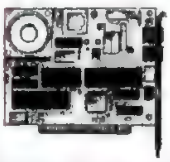

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CIRCLE 283 ON READER SERVICE CARD

edited by
Matthew J. Ross

Read Only

Reviews of the Latest Books for the PC User

Maximizing the Home PC Office

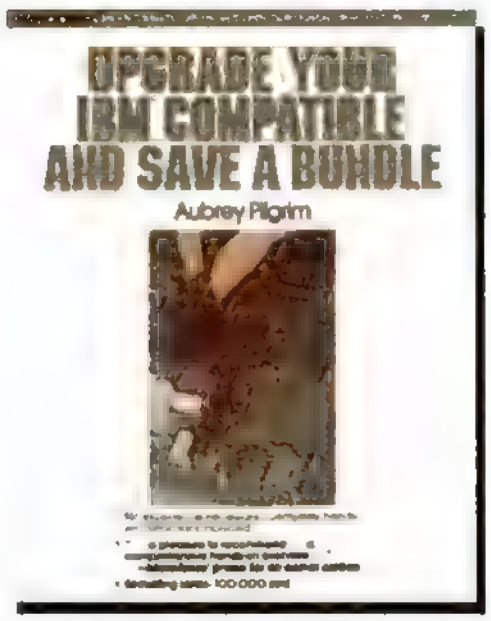
■ *Upgrade Your IBM Compatible and Save a Bundle*
by Aubrey Pilgrim
Windcrest, $16.95

Upgrade Your IBM Compatible and Save a Bundle answers the question in the back of many peoples' minds: "What am I going to do with this old machine?" For those who want something new but balk at the price, or for the user who craves something as fast as his machine at work, Aubrey Pilgrim offers a simple solution—upgrade.

Pilgrim's book offers helpful insights, good illustrations, and well-reasoned explanations. Pilgrim does not automatically suggest that everyone upgrade to a 386; rather, users are encouraged to examine the reasons why they need to upgrade, including both their needs and their budget. Every aspect is covered: Pilgrim even provides tips for picking up used equipment, a path for upgrading not considered by many users.

Each chapter and its attendant subsections devoted to particular components of the machine are liberally and clearly illustrated. However, the experienced user might find that Pilgrim's book plods along and covers already well-traveled ground.

One good point is that Pilgrim pays close attention to those portions of the machine that typically receive little credit for their contribution. His section on BIOS, for instance, is as clear and helpful as you'll find anywhere, and the work he does describing the inner workings of devices like hard disks or the different types of RAM are worth nearly everyone's time. Video upgrades are handled adroitly here too.



***Upgrade Your IBM Compatible* gives hands-on instructions to upgrade your system's memory, hard disk, and video.**

Pilgrim is a Los Angeles-based writer, and his bias toward the southern California area is readily apparent. When he suggests specific stores and outlets to obtain various components, most of them are found in California. But Pilgrim also provides a list of free and subscription-based publications, as well as a listing of on-line services.

This book appeals on many different levels. For technical novices, the book's this-is-a-disk-drive approach may prove to be their salvation, while for more-experienced users, it may be too simple, though handy to have on a bookshelf. As a reference for any user, though, this book will prove to be invaluable.—**Fredric Burke**

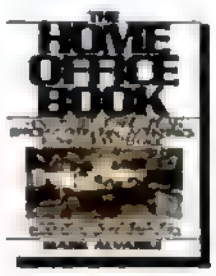
Windcrest—Tab Books, Blue Ridge Summit, PA 17294; (717) 794-2191.
ISBN: 0-8306-3468-1

CIRCLE 396 ON READER SERVICE CARD

■ *The Home Office Book*
by Mark Alvarez
Goodwood Press, $14.95

Setting up and maintaining a home office presents all sorts of challenges. Suddenly you're a person with many hats—the one responsible for making decisions regarding all facets of office life—from furniture to faxes, from couches to computers. *The Home Office Book* from Mark Alvarez is a chatty, quick read that's designed for the home office neophyte. It takes you through the building blocks of the generic home office including computers, software, furniture, and room design.

Alvarez brings two-fold expertise to the book. He's worked for a number of house and home publications, and he's been a home office worker for more than a decade. He brings an aesthetic, practical knowledge of spaces to his discussions of the home office environment, and he quickly illustrates the trade-offs involved in setting up shop. Alvarez is at his best when he's describing the various modular furniture offerings available.



Alvarez then proceeds to dive into the computer age. His chapters on which computers and software to buy are concise and to the point. At the risk of presenting just enough information to make you dangerous, Alvarez tells you what you need to know to make an intelligent buying decision regarding computers, software, and peripherals. The no-nonsense advice (an SX is a good buy, consider an integrated package or shareware) is sane and tame, but without much detailed explanation behind the dictums. I wouldn't make a buying decision based on the book's information; use it instead as a springboard for further investigation.

Maxims such as "stay away from release 1.0" of any software are gems that novices might not think of, but for the most part the book is a highly readable rehash of computer basics. Interesting sidebars on topics such as PostScript, shareware, and on-line services offer slightly more depth.

Alvarez moves onto those tough office purchases: fax, phone, and other hi-tech alternatives such as PC voice mail. Chapters on how to design and light your office (as well as arranging the stuff you bought) offer good summaries of the alternatives. Finally, a chapter that includes issues such as taxes and loneliness demonstrate a clear understanding of home office issues.

Whether you're just beginning or already operate a home office, reading this book is like commiserating with a friend. Alvarez has obviously done his time in the home office. My greatest concern is that the book diverts attention from the real issues. Your furniture, room design, and even your PC are cosmetic accoutrements. Without a solid business idea and good sense, you'll quickly wind up back at the corporate water cooler.—**Robin Raskin** ■

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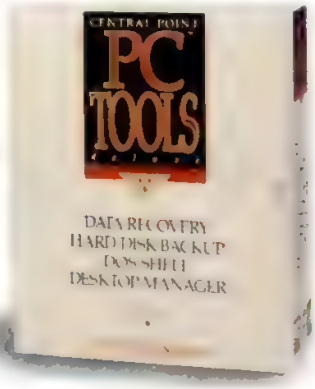

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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Kodak and Adobe Close to Solving Problems of Printing Color Photos

After sitting out much of the PC revolution, Kodak has finally decided to get involved in it in a big way.

Two issues ago, I detailed how their Photo CD system—which puts ordinary 35-mm. photographs on compact disk—had major implications for graphics on PCs (November 27, 1990).

Now, even though Photo CD is still over a year away, Kodak is making an attempt to take a leadership role in defining how color photographs are displayed, stored, and printed.

Right now, major problems confront anyone trying to publish color documents with a PC or workstation.

Color software on a PC offers lots of tools for fiddling with hues and tones of images after they've been scanned, but without a color-image specification, you can't get a reliable reproduction of the screen image. None of the devices are calibrated to the same color definitions.

Today, a designer who uses a paint program to carefully edit the colors in a scanned-in photo can be horrified to find the wrong colors printed after intermediary software has converted the file for the separation process.

Adobe's PostScript has become the common page description language that connects PCs and dedicated page-composition systems in producing black-and-white publications, but there's still no common ground for printing color images.

Adobe is in the process of perfecting color extensions to PostScript but it needs a way to define how photographs will be addressed and stored.

Kodak is proposing just that: a device-independent color management system that can represent millions of colors and has built-in compression algorithms. It's only in its first stages of public discussion and has not been fully detailed, but it has the potential to become a solution across all computer platforms. Adobe, Aldus, Apple, IBM, and Sun are among the technology's initial supporters.

After sitting out much of the PC revolution, Kodak has finally decided to try and get involved in a big way.

Adobe is very enthusiastic about Kodak's proposal; in fact, the two companies have been working closely in developing the specifications.

The Kodak color system is made up of a group of software products that will enable programmers to calibrate existing software and hardware to a specification being called PhotoYCC. The term PhotoYCC is not strictly an acronym; it's an amalgamation of the way broadcasters and photographers refer to image reproduction: the Y implies luminescence (the gray level) and the two C's together represent chrominance (the hue and saturation level).

There will be software tools to give programmers access to the PhotoYCC model from whichever standard their products currently use: the RGB (red-green-blue) standard used for displays, the CMYK (cyan-magenta-yellow-black) system used by printers, or any of the CIE color space models.

Of course, Kodak's Photo CD system will be fully compatible with this new system.

With only Photo CD and software libraries to sell, and long experience in color reproduction, Kodak may prove to be exactly the right company to establish this standard. For Kodak, new business development is a top priority, since it had to withdraw from the instant-camera business.

And for Adobe, the emergence of a new standard for storing and retrieving color images is added insurance that PostScript 2 will finally bridge the gap between what you see on a color screen and what you get on printed paper.

HOLD ONTO YOUR HAT: INTEL'S STARTING TO TALK ABOUT THE 586

Intel may be in the driver's seat for PC microprocessor design, but it's acting like the competition is breathing down its neck.

The company said it plans to ship the first 586 chips in 1992, although it isn't yet prepared to say how the next microprocessor will top the 486.

For the past year, Intel has solicited the opinions of designers at the leading PC manufacturers on the types of features they'd like to see in the 586.

Intel's chief executive Andrew Grove has said he feels that Intel needs to be more aggressive in its development of faster versions of the 486 and in its revisions to the line. Intel president David House recently confirmed that Intel plans to produce a 50-MHz version of the 486 in 1991. He also believes that the 486 will eventually replace the 386 as the company's leading microprocessor.

To help reach that goal, Intel's stepped up its marketing campaign for the 486.

PARADOX SALES SURPASS BOTH VERSIONS OF dBASE III+ and IV

Paradox has been steadily gaining popularity in recent years and it may finally be on the verge of emerging as the leading database manager for PCs.

Computer Intelligence, in La Jolla, Calif., tracks the software bought by large companies. For the month of September, 1990, *Paradox* beat the combined sales of *dBASE III Plus* and *dBASE IV* by ten percentage points, with 44 percent of the market, compared to *dBASE*'s combined total of 34.

Paradox's sales to big companies have climbed dramatically over the last six months, while Ashton-Tate continued to hold onto the biggest share of the total market with its two versions of *dBASE*. By September, however, *Paradox* overtook the two for the first time.

DataEase International's *DataEase* also made strong sales gains in recent months, reaching 12 percent of the total market for September. *R:BASE*, *SMART*, and *FoxBase* maintained their positions in the secondary level with shares of about three percent each.

CONTINUES ON PAGE 68

Pipeline

CONTINUED FROM PAGE 67

OSF DELIVERS THE GOODS; NOW IT'S UP TO THE MARKET

After a closely watched development cycle, the Open Software Foundation finally finished the operating system that is supposed to change the course of Unix: OSF/1.

Most of the foundation's sponsors vowed to integrate OSF/1 with the current versions of Unix in their product lines over the coming months.

IBM said that it intends to base future versions of AIX on OSF/1, covering systems from the PS/2 up to the 3090.

Hewlett-Packard gave a more candid explanation of its strategy. Chief executive Dean Morton said, "HP's first step in demonstrating our commitment to OSF/1 will be to put it on the RISC workstations we'll be shipping next year.

"Our goal is to get the maximum acceptance of OSF/1 by putting it on our hottest workstation product. Then, as soon as possible, we'll migrate the rest of our workstation and multiuser systems that currently run our HP-UX and DOMAIN operating systems to the OSF technology base."

DEC said it will base the next version of ULTRIX on OSF/1 and will ship a merged ULTRIX-OSF/1 product within a year.

NCR MAKES NEWWAVE A MAJOR PART OF ITS ENTERPRISE-WIDE LINE

NCR has an ambitious plan to develop modular systems that can handle a corporation's computing needs at every level. Called Cooperation, it's designed to be a fully open system with access to all the major environments, from LANs to WANs to minis to mainframes.

But one of the more interesting aspects is NCR's choice of *NewWave*, the object-oriented extensions to *Windows* that Hewlett-Packard developed.

Large systems vendors need some kind of graphical front end that can simplify the sophisti-

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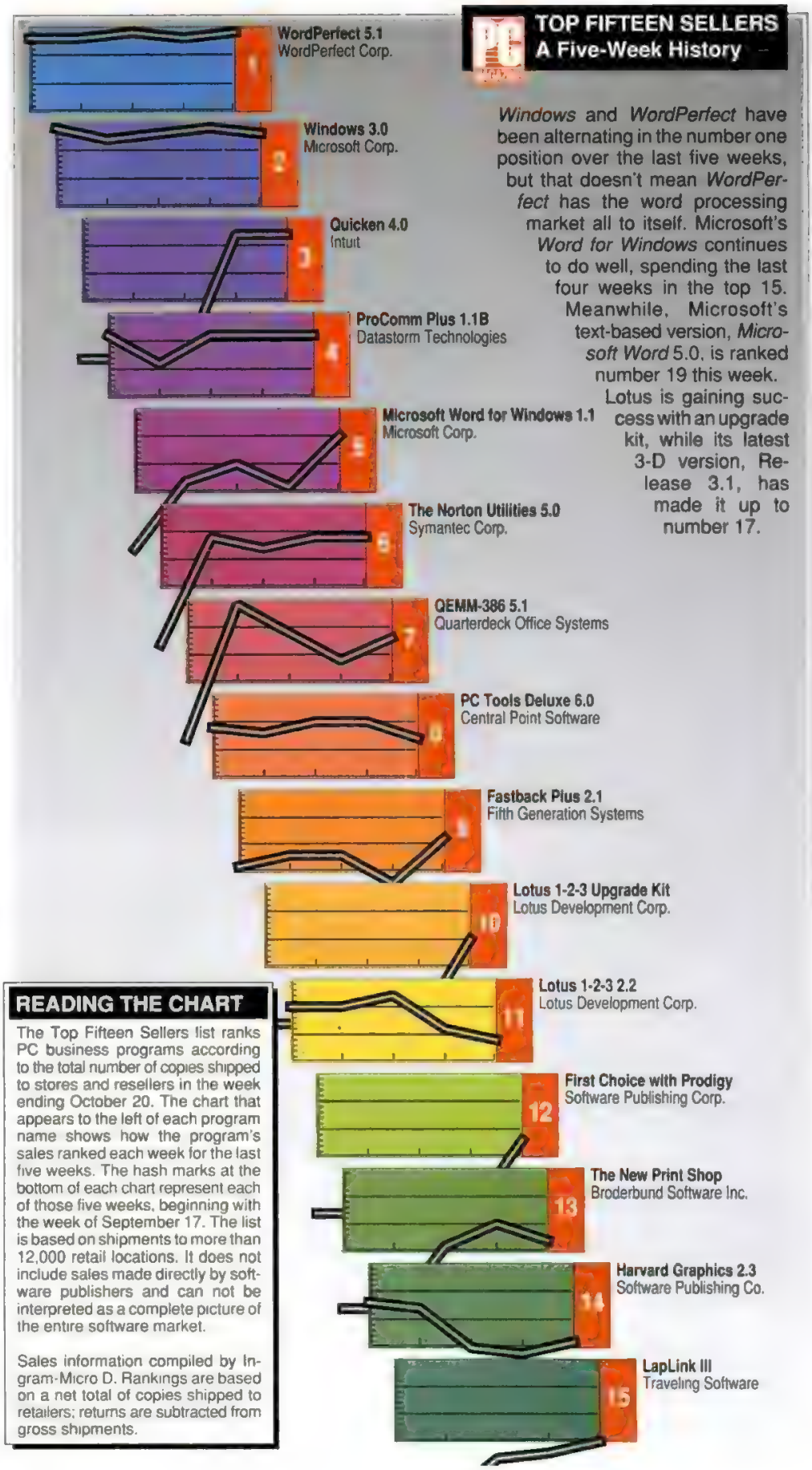

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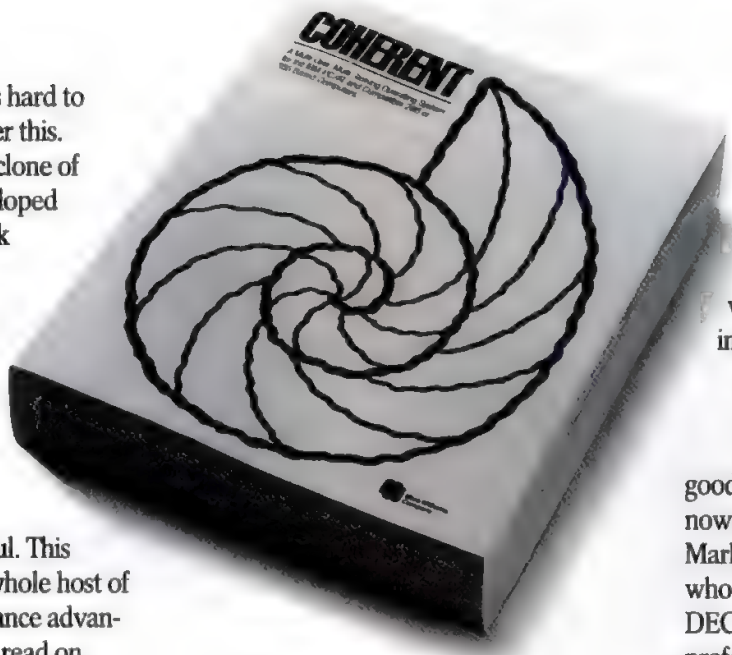

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Price	$99.95	$1495.00

*Byte Exec benchmark, 1000 iterations on 20 MHZ 386.
Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. SCSI device driver available soon. Does not run on Microchannel machines.

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NEC

Pipeline

CONTINUED FROM PAGE 68

cated back-end communications chores. IBM developed *OfficeVision* as a proprietary derivation of OS/2.

HP is on the same track with *NewWave* and the fact that NCR is willing to adapt *NewWave* for its emerging platform says a lot about both companies' interest in open systems.

The leaders in file-transfer and windows utilities have gotten together on a technology-sharing arrangement.

With Unix users still trying to wrest control of that operating system away from AT&T, cooperation between companies like NCR and HP on *NewWave* is like a breath of fresh air. In spite of the potential for IBM and Microsoft to restrict growth with their control of PC operating systems, the reality seems to be that the DOS-OS/2 environment provides strong opportunities for growth. And they didn't even have to form a committee to do it.

TRAVELING SOFTWARE TEAMS UP WITH HDC TO DEVELOP WINDOWS FILE-TRANSFER SOFTWARE

Strategic alliances aren't just for big companies.

The leaders in file-transfer and windows utilities have gotten together on a technology-sharing arrangement.

Traveling Software contributed its *WinConnect* utility to hDC for inclusion in a new group of file utilities called *FileApps*, and Traveling Software will include an hDC utility, File Enhancer, in *WinConnect*, a file-transfer program that runs under *Windows*.

hDC's development kit for *Windows* programming is credited by both parties as the key that made this technology transfer work.

Development tools for *Windows* have suddenly become a growth industry; about half a dozen new companies are planning products.

Whitewater Group, which was the first company to sell *Windows* tools, has taken the concept a step further: it's created a fast-track program where programmers can spend two weeks at Whitewater's offices, taking advantage of all the code and brainpower Whitewater has, to get a *Windows* application running. ■

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Bill Machrone

What's in A Name?

A rose by any other name would smell as sweet, but frankly, some of the words we have to deal with stink.

Apart from the bafflegab, technobabble, and gobbledygook we're subjected to daily in this business, some of the common definitions are just plain wrong. It's too late to save some of them; for others there may be hope.

Take *hacker*, for example. This word once described a person utterly dedicated to understanding and applying the underlying technology of hardware or software—someone who was not afraid to pick up a soldering iron and build something from scratch.

The first hackers didn't eat, drink, or sleep in their quest for perfect understanding of the processor, the operating system, or the application. But the popular press stumbled across a criminal subspecies of hacker-like people who were breaking into other computers and sometimes wreaking havoc. In the ensuing articles, the original definition of the word was irretrievably lost. I used to be a hacker. Now I'm an early adopter or a pioneer or something. It's just not the same.

EDUTAINMENT

This recent coinage was founded on the thesis that educational software is inherently boring, while entertainment software is inherently worthless. *Edutainment* hopes to convey the sense that software for children can be educational and entertaining at the same time. One critic sniffed that "the word *edutainment* was coined by someone who obviously knew nothing about either." I'm not so sure that's true; I've seen worthy examples of entertaining, educational programs, such as the *Carmen Sandiego* collection.

The Learning Company's Sharyn Fitzpatrick offers an exceptionally levelheaded counter-definition to edutainment: children's software. The implication, of course, is that it all should be this good. The cold fact of the moment is that it isn't. The advent of computers with higher video resolution and infinitely superior sound will make these programs far more engaging and therefore more educational. The capabilities offered by the new hardware may just salvage the respectability of both educational and entertainment software, obviating the need for a new word.

80486

What's this doing on the list? It's my contention (and I'm not the only one) that the 80486 is an utter misnomer. In earlier examples of Intel "hundreds-level" revisions, there have been major enhancements to the chip's addressing capabilities and changes in the instruction set. What we have in the 80486 is a 386DX with a math coprocessor and a little bit of cache. Yes, it's a marvel of integration. Yes, it's faster. Yes, the demand is an insignificant fraction of the 386 market.

What's the problem? Intel erred in naming it a 486 because it calls undue attention to the CPU chip in the approval process. Coupled with the fact that the 25-MHz 486 only offers a 12 to 15 percent boost over a 33-MHz 386, it's tough to justify.

Better for Intel to have named it the 386MX. The M would signify that there's a math coprocessor on-board, and we'd all get a cheap thrill out of saying "386MX" for the first week. Intel would have been able to position the chip as a cost-effective, highly integrated

ILLUSTRATION: STEPHEN SWENY

choice in an already approved product family.

Instead, we got a raft of pointless machines like IBM's Model 70 with the Power Platform, and others that were not significantly faster than their 386 forebears. The on-board cache is woefully inadequate for serious applications, so the only time the 486 saves you money is when you absolutely need the math coprocessor. Have you checked the list prices for 80387s lately? If you can believe it, Intel asks a mere

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Speed will be the final factor to differentiate the 386 and the 486. The chip architecture and Intel's marketing will limit the 386 to its current 33-MHz plateau, while the 486 will go on to 40 and 50 MHz. But that's a poor excuse for the chaos caused by the introduction of the 486.

MULTIMEDIA

In time, we may be able to do something about this one. Multimedia hardware and software are definitely on the way, but the term itself is a complete misnomer. We're really talking about extended video and audio performance here, and the inclusion of a CD-ROM player. So, yes, there are multiple storage media, but that's not the important part. A traditional multimedia system with videodisks, slide projection, stereo playback equipment, and expensive synchronization hardware was necessary to match the capabilities of the new Level One specification PCs.

According to the Level One specification, which grew out of the annual CD-ROM conferences, these machines will show photorealistic 256-color VGA images, sport stereo digital-to-analog converters, and have an on-board digital signal processor for sound synthesis. So it really represents the end of crummy sound and barely adequate video, not a whole new set of presentation media. PCs have always made sound and put images on the screen. Why should we start calling them multimedia machines just because they're finally doing it passably well?

I propose that the industry come up with a stylized logo, a triple S, or S cubed, that stands for Sight, Sound, and Storage. It would be affixed to the front panel of Level One machines, and come in the form of a sticker included with the upgrade boards that will take 286 and 386 machines in the installed base to the Level One specification.

We in the press are chiefly responsible for disseminating these coinages and perversions of meaning, but it's everyone's responsibility to police the language and keep our communications as meaningful and free of unnecessary jargon as possible. Our everyday shorthand, such as MIPs, megs, and LANs, streamline communication; bad coinages impede it. ■

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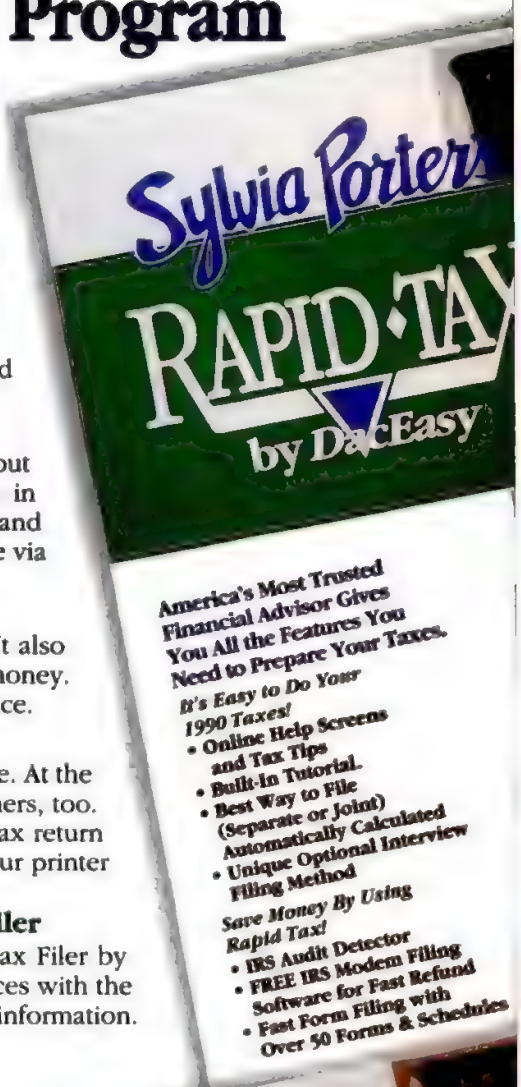

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John C. Dvorak

The Seven Deadly Sins of Computing

Our virtuous columnist denounces the modern evils affecting today's personal computer users.

Mankind has been plagued by sin. Ask any preacher. Ask any sinning preacher. While the Ten Commandments offered a grand set of rules to decide your eventual fate after death, the classic Seven Deadly Sins decided your fate while you were alive. These terrible everyday sins have not gone away, and curse us to this day. In fact the modern computer users, unaware of their influence, may not know that most aspects of computing are dominated by these sins and their effect on the hapless (and naive) computer user.

Let's look at how this works.

Sin Number One: Sloth Few computer users can avoid this most terrible and debilitating of sins. When was the last time you brought yourself to read the documentation provided with software? Too lazy? Didn't think it was important? How about cleaning that grimed-up CRT screen? When was the last time you talked yourself into doing that tiresome chore? Some users haven't been able to spend the 15 minutes it takes to upgrade to the latest version of DOS as they run DOS 2.0. "Oh, why bother, I'll wait until DOS 5."

Sin Number Two: Avarice, Greed Ever go to a friend's house and demand bootleg copies of software that you know you'll never use? You want copies only because you "must have a copy!" Some greed-ridden lost souls spend all their time downloading free programs from GEnie even though they'll never look at them. "More, more, more!" More money spent for on-line services is the real result of greed.

Sin Number Three: Jealousy, Envy You get upset with the friend who has the newest 486 machine. *You too* must have one, whether you need it or not. You lose sleep and money.

Sin Number Four: Gluttony You have a 200-megabyte hard disk, and you've managed to feed it until 198 megabytes are filled—mostly with crap-ola. Unknown files, weird utilities, null value programs. But can you bring yourself to erase these things? "They might be important someday." So you buy another 200 megabytes of storage instead.

Sin Number Five: Rage This comes from the time-wasting aspect of computing. You spend all afternoon reprinting one document "trying to get it just right." Or you spend all day mesmerized by Tetris and can't break loose. When you get home you kick the dog.

Sin Number Six: Lust You spend time poring over computer magazines looking at all the latest new products. You dream of them. You try to talk your spouse into letting you buy them. You actually drool over ads in *PC Mag*. (Well, maybe this isn't such a bad sin. It pays *my* bills!)

Sin Number Seven: Pride You gloat over your equipment. You brag to your friends. You tell them how really, really fast your machine is compared with theirs. You show them a wall of DOS performance books and crow about how you know every tip and trick. You're the big shot in the office. When someone needs to know something, you'll tell them what you think about it, whether you know anything or not. You've become a blowhard.

Now few computer sinners suffer from all of these sins. It's almost impossible. But most of us are afflicted by at least one. Everyone, that is, except me. Why would I care? I get free review copies of software and hardware to examine. Send it all!! This way I can put it on the shelves and show it off for everyone to see as they cower before my mighty 486 and giganto color monitor. Pride? Gluttony? Avarice?

Moi?

ILLUSTRATION: STEPHEN SWENY

Sharp Professional Products presents:

A Guide to Giving The Most Persuasive Presentation Possible.

First pointer: Project!
Take your story to the big screen with Sharp's new QA-75 LCD projection panel. Imagine the impact when you transfer your presentation directly from your small computer screen to the big screen—where everyone can benefit from it. The QA-75, when used with a standard overhead projector, projects information from any popular PC—including the PS/2 and MAC II!

Second pointer: Use the pointer
Your presentation is more effective when you interact with your audience. Using the QA-75's wireless remote, from anywhere in the room, you can adjust the image, access on-screen menus and control your PC. It even has a built-in pointer.

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With the QA-75, unlike slides, transparencies, or even videotape, you have the flexibility to make on-the-spot changes to your data. So, if someone has a bright idea while the presentation is going on, it can be instantly incorporated into the program.

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QA-75 LCD Panel

Actual Display

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CIRCLE 193 ON READER SERVICE CARD

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FROM SHARP MINDS COME SHARP PRODUCTS™

John C.
Dvorak

Inside Track

Is there an attempt to **suppress the facts** about the **performance** potential of the Intel i860 RISC chip? That seems to be a theme I keep hearing. It's easy to see why when you put a MicroWay i860 card into a 386 machine and discover that you're running at over 40 mips!!

Dubbed the **Number Smasher 860 Coprocessor card,** the board comes with 8 megabytes of RAM and is available at 33 or 40 MHz. While not cheap at $6,995 for the 33-MHz model, and $9,200 for the 40-MHz model, you do get one of the MicroWay NDP compilers for free. MicroWay offers Fortran, PASCAL, and a new C++ compiler tailored for the 860 card. The 860 becomes the primary processor, and its number-crunching capabilities are **incredible.** The 386 controls the hard disk and acts as an ancillary processor in this scheme. This **reverses the priorities** encouraged by Intel. One company insider told me that Intel wasn't too pleased with the MicroWay card because it de-emphasized the **cash cow** 386 and drew attention to the high-performance RISC chip.

> Intel isn't pleased that companies de-emphasize its cash cow, the 386, by drawing attention to the higher performance i860.

This reminds me of the time chip designer Roger Ross—the designer of the Motorola 88000 RISC chip—told me that **no finer CISC chip** was ever developed than the 486 and **no worse RISC chip** was ever designed than the i860. "But the i860 will still outperform the 486!" he said.

For those who are still **suffering from the 286-AT blues,** MicroWay has one of the niftiest add-in 386SX cards available, the FastCache-SX, and it sells for $595. Call the company for more information and a **list** of all its products. The company is in Kingston, Mass., (508) 746-7341, fax (508) 746-4678.

Meanwhile, on the Other Side of the Chip Dept.: If you need a **new hi-tech buzzterm,** try *hyperstone*. It refers to a new microprocessor design recently licensed by Zilog (remember them?) from **Hyperstone Electronics** in West Germany. The hyperstone design supposedly has the **most performance per transistor** and uses a combination of RISC and CISC design parameters. The hyperstone designer calls this **EFISC** (another new buzzterm) for enhanced fast instruction set computer. Throw that around at the next cocktail party.

Never Say Never Dept.: I've been telling vendors that I'm not interested in laptops that weigh over 4.5 pounds. Meanwhile, there is a wave of inexpensive, yet powerful, 6.5 pounders hitting the streets all at once. In this category I'm most **impressed with the Zeos Notebook 286.** With its 20MB hard disk, built-in floppy and VGA screen all for $1,995, it has to be the **number one contender.** As well-engineered and nifty as this machine is, I'm most impressed with the latest "Zeos touches." St. Paul-based Zeos International (612-633-4591, fax 612-633-1325) may be the most **tasteful and genteel** of all the high-profile cloners. Designed in-house, the little notebook is very artsy in its look and feel. But I was most **impressed with the shipping box** in which it came, **no kidding.** You should order one just to check out the packaging. There is a box inside a box with "Thank you" emblazoned on the inner box. The case for the laptop has custom pockets and inside the disk pockets are blank disks! Highly recommended company in general.

The End Is Near Dept.: At least it is for photography as we know it. Kodak is trying to promote a new concept where it will put your **photos onto a CD-ROM** at beyond HDTV resolution. A CD-ROM will hold 100 pictures. The initial advantage is convenience, but eventually we'll all be manipulating images and the day of the snapshot will be over as the family **squeezes and twists** the photo of little Becky until she looks like **an alien.** Family fun in the 21st century.

More CD-ROM Nonsense Dept.: Author David Rothman showed me a press release he received **from the CIA** advocating a new CD-ROM standard to be used by the intelligence community. The release said, "The U.S. Intelligence Community has proposed a standard for CD-ROM read-only data exchange that is designed to facilitate the interoperability of CD-ROM data bases among all operating systems, CD-ROM drives, access/retrieval programs, and user interfaces. The Information Handling Committee (IHC) of the Intelligence Community is responsible for developing the proposed standard." It goes on and on mostly in government bureaucratese to wit: ". . . to facilitate the efficient sharing of data bases across organizational boundaries and between headquarters and field components." This standard is called **the CD-RDx standard.**

Rothman **fears the worst** with this crowd: *Just imagine some trench coats herding the top CD-ROM developers into a basement room with naked bulbs and keeping them locked up until they agree on standards. Obviously this would be more effective than your garden-variety symposium.*

To get a copy of the proposed CD-RDx standard write: IHC, Intelligence Community Staff, P.O. Box 90828, Washington, D.C. 20090. When asked if there was a fax or phone number that could be called to expedite this process, they told me "no"! I'm sure the standard will be as modern as their **exclusive use of the U.S. Mail** for information exchange. Either that or you just **mention to your spouse** that you want a copy of the CD-RDx standard, and one appears the next day. ■

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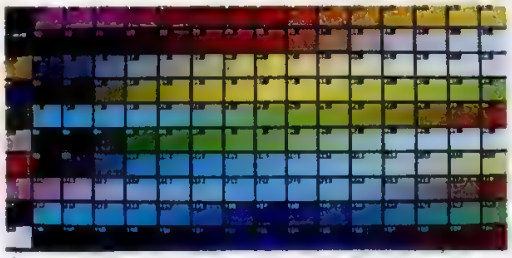

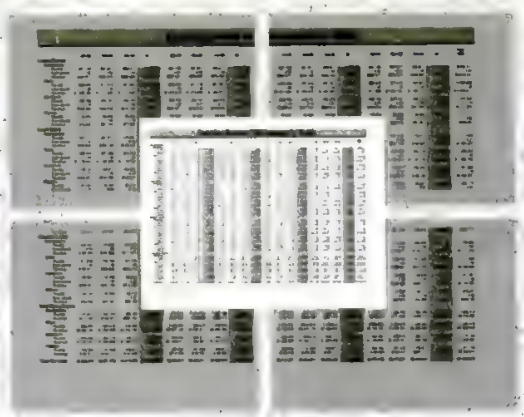

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Our Graph Editor lets you add freehand drawings or symbols to call attention to critical data.

Q4	1989
2,415,407	6,886,910
1,987,897	5,573,029
1,331,601	3,789,665
5,734,905	16,249,604
3,61[illegible]29	12,880,958

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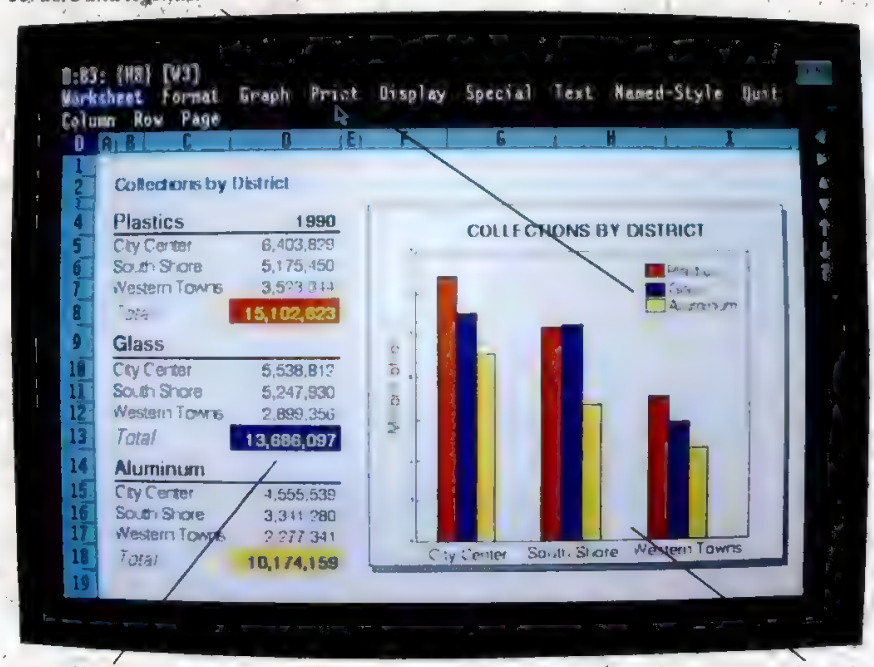

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And even more importantly, we've

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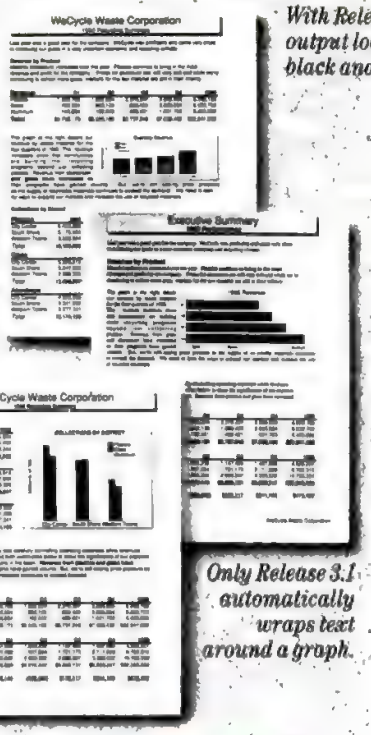

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Choose from 8 combinations of Bitstream® typefaces which you can scale from 3 to 72 points.

Align titles or text – left, right, even or center – with one simple command.

WeCycle Waste Corporation
1990 Recycling Summary

Last year was a good year for the company. WeCycle was profitable and came very close to achieving our goals in a very uncertain economic and recycling climate.

Revenue by Product

Material collections increased over the year. Plastics continue to bring in the most revenue and profit for the company. Prices for aluminum are still very soft and while we're continuing to collect more glass, markets for the raw material are still in their infancy.

Revenue	Q1	Q2	Q3	Q4	1990
Plastics	1,890,785	1,982,024	2,378,397	2,836,983	9,088,189
Glass	1,700,504	1,862,135	1,869,430	2,600,684	8,032,753
Aluminum	1,146,884	1,182,022	1,489,421	1,601,763	5,420,090
Total	**$4,736,173**	**$5,026,180**	**$5,737,248**	**$7,039,430**	**$22,541,032**

Only Release 3.1 automatically wraps text around a graph.

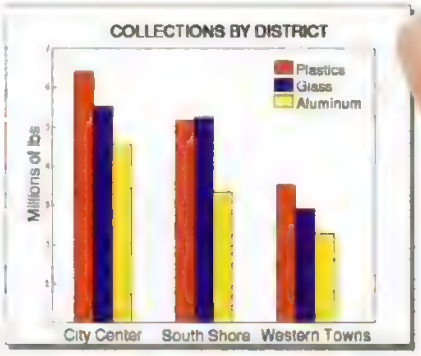
The graph at the right details our revenue by waste material for the four quarters of 1990. The revenue increases show that communities are building their recycling programs beyond just collecting plastics. Revenue from **aluminum and glass have increased** as their programs have gained volume. But, we're still seeing price pressure as the supply of recyclable materials continues to exceed the demand. We need to look for ways to expand our markets and increase the use of recycled materials.

Collections by District

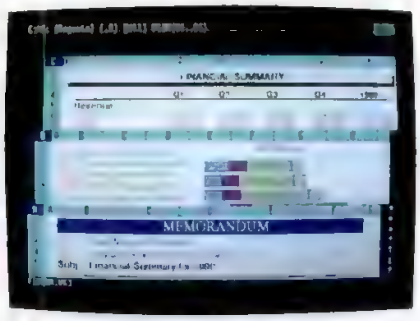
Plastics	1990
City Center	6,403,829
South Shore	5,175,450
Western Towns	3,523,344
Total	[illegible]

Glass	
City Center	5,538,812
South Shore	5,247,930
Western Towns	2,899,356
Total	[illegible]

Aluminum	
City Center	4,555,539
South Shore	3,341,280
Western Towns	2,277,341
Total	**10,174,159**



Release 3.1 runs in Windows 3.0. Just click the icon and you're on your way.



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When Accounting Today (May 1990) asked accountants which accounting software package they recommended to their small business clients, an overwhelming 29% said they recommend Peachtree Accounting– that's almost double the next largest competitor.

Reseller Management (March 14, 1990) asked resellers which accounting package they recommend and Peachtree came out on top again with 25% of resellers recommending it.

But accountants and resellers aren't the only ones giving Peachtree rave reviews:

"If you could find a definition for Peachtree in the dictionary, it might be 'value for your money.'"–PC Magazine 4/10/90

"It is, I believe, the best accounting package available for the price."–E.J. Bosmeny, CPA, Naperville, IL

"Complete III rivals packages costing 10 times as much."–PC Resource, July 1990

If there's one thing people agree on, it's what a great value Peachtree's Double Bonus Bundle is. That's because it includes two first-rate software packages for one low price– Peachtree Complete III, a full-featured accounting system, and Peachtree Data Query III, a reporting and analysis tool.

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"Installation is easy, data entry is fast...a joy to use."–PC Resource, July 1990

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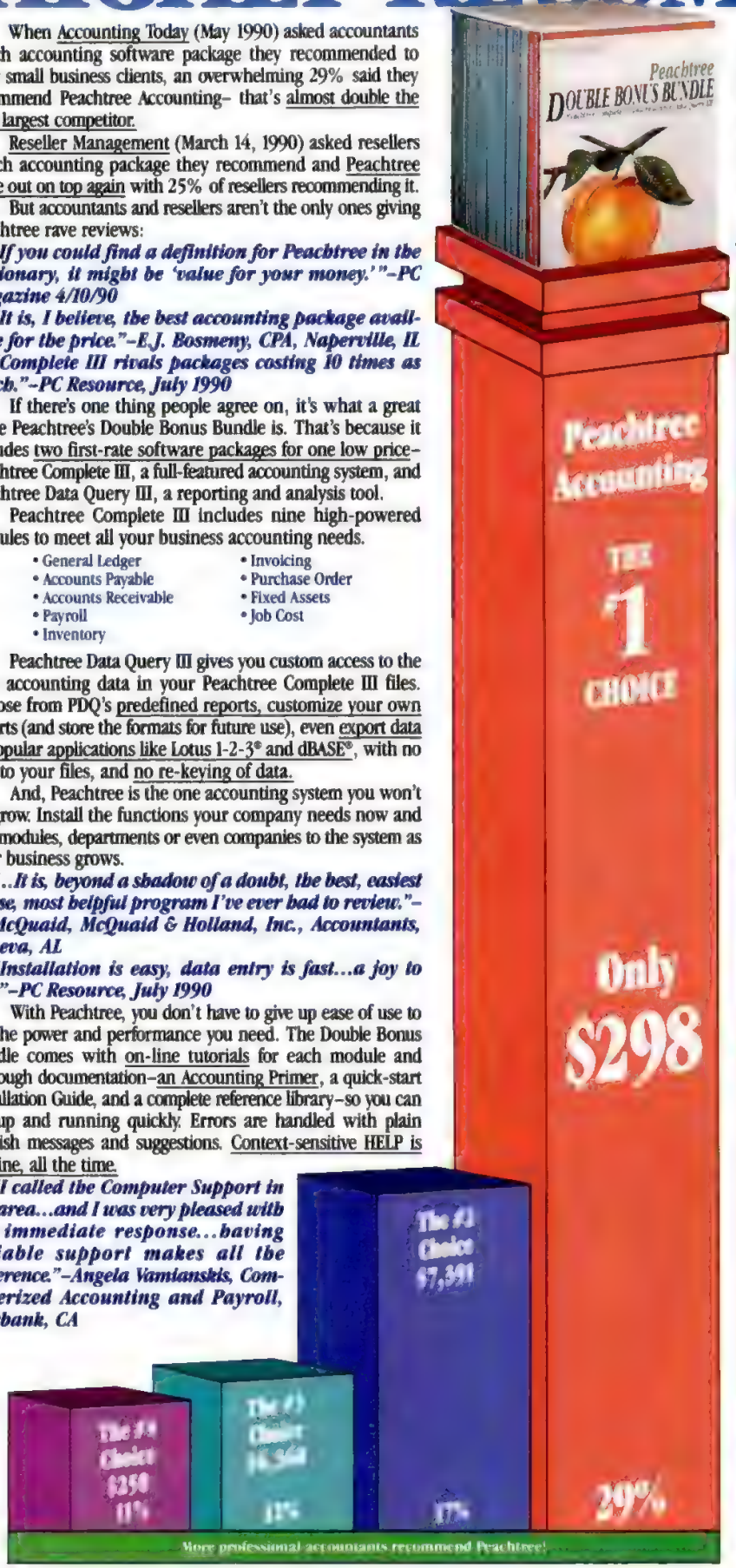

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- Prints miscellaneous 1099's

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CIRCLE 358 ON READER SERVICE CARD

PCM

Jim Seymour

The New Generation Of Windows Displays

As the world turns graphical, users want better display systems to see the whole picture. Manufacturers must respond to the demand for larger, cheaper displays and higher resolution adapters.

I think the success of *Windows* 3.0 is going to change how we think about PC monitors. And in the process, it's going to turn that market, its display standards, and its price points upside down.

I reach that conclusion through an eight-step analysis of what *Windows* and *Windows* users really need. Walk through this with me:

(1) The wide use of *Windows* is going to help people understand the usefulness of having several files, and often several programs, open on-screen at once.

(2) It doesn't do much good to have several windows open at once unless you can actually see what's going on in each one. The windows have to be fairly large.

(3) Accommodating several sizable windows means you need a large-screen display. Thus the success of *Windows* is going to drive what will be a white-hot market for larger monitors.

(4) The use of color in a *Windows* 3.0 display is critical in helping users differentiate between the windows, and the processes running within them. Monochrome monitors, regardless of size and resolution, are lousy with *Windows*. The monochrome market is not long for this world.

(5) When you have several windows open at once, each of fairly large size, on that large display, you discover size and color aren't enough: You also need lots of resolution. Blowing up VGA (640 by 480 pixels), or even Super VGA (800 by 600), to, say, the size of a 19-inch screen isn't enough. Microscopists and astronomers call that "empty magnification": a bigger picture that carries no more information. So VGA, while certainly not dead (especially with help from Edsun, the anti-aliasing VGA-display wizards), is not going to be *the* standard much longer. We're going back to a multiple display-standards world once again.

(6) When you've got to push that many pixels around, several bits deep per pixel (for a large color palette), screen redraws slow to a crawl. That makes some kind of graphics acceleration a must: People aren't going to put up with sluggish displays just to get big screens and high resolution. Whether the future lies with Texas Instruments' flavor of graphics acceleration, or Hitachi's, or other vendors', I think speed-up circuitry will be a standard part of the next generation of high-res *Windows*-oriented video-display cards.

(7) The complications of matching video cards to video displays, once you get beyond VGA-level resolution, are getting out of hand. Every time you see a *PC Magazine* review of monitors or video cards with better-than-VGA resolution, you also see a companion sidebar on how to run the maze of choosing the right card or monitor to use with the products reviewed in that story. Given the complications of effectively integrating all these performance-related demands, and then actually selling that performance package to end users, we're going to see a lot more integrated monitor-plus-video card (plus *Windows* 3.0 drivers) packages appearing.

(8) Those demands for screen size, color, high resolution, and fast performance are going to heighten our sensitivity to related display issues, such as antiglare features, much flatter to truly flat screens, and display cabinets which waste as little desktop real estate as possible.

ILLUSTRATION: STEPHEN SWENY

All that says to me is the day of the 12- to 14-inch VGA monitor as the business standard is drawing to a close. But what's going to replace all those medium-sized VGAs?

My guess is that the business PC-display market will split between 1,280-by-1,024 non-

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CIRCLE 724 ON READER SERVICE CARD

interlaced displays for high-end uses, and 1,024-by-768 (8514a-level) noninterlaced displays as the more commonplace standard.

BIGGER IS BETTER

Screen size? Sit down at a PC equipped with a 19-inch high-resolution display running *Windows* 3.0 and you'll see in a few seconds why *Windows* makes sense—even if you're a confirmed *Windows*-hater. Don't let anyone tell you big displays are only for CAD or desktop publishing work: They're a joy for anything you do at the PC. But as nice as 19-inch displays are, they're big, heavy, and expensive. So I look for the emergence of a "semi-big" screen size—probably a 16- or 17-inch diagonal screen—as the companion monitor for those 1,024-by-768 video cards.

It's easy to look at each step in that theory and see dollar signs. In fact, every one of those heightened expectations *is* potentially costly. Add 'em all up and you wind up with $5,000 display systems.

Which is about what the display I'm using right now costs. It's a superb new 19-inch 1,280-by-1,024 noninterlaced system from Moniterm. A Hitachi graphics chip speeds up redraws; a flat tube gives an incredibly good picture; and smart firmware on the Moniterm-designed card allows me to move instantly around a four-screens-size "virtual desktop."

And when I'm not running *Windows*, it provides an enlarged VGA display that fills the screen, thanks to the close fit between 1,280 by 1,024 and 640 by 480.

It is by a large margin the best display system I've ever seen on a PC. And it's available today, not someday. I think this Moniterm package points the way toward that next generation of display systems in almost every area. Except, of course, price.

Businesses aren't about to spring for displays that cost $5,000 a pop for everyone's PC. But there's magic in the $1,500 street-price range, and that's where I'm convinced the fat part of this coming "*Windows* display systems" market is headed.

Vendors: Put those features I listed above on a card with 1,024-by-768 res, package it with a sharp, bright 15-inch monitor, and price it in the neighborhood of $1,500.

Then stand back, lest you get trampled by the crowds. ■

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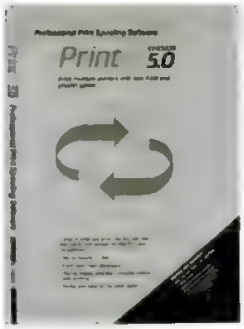

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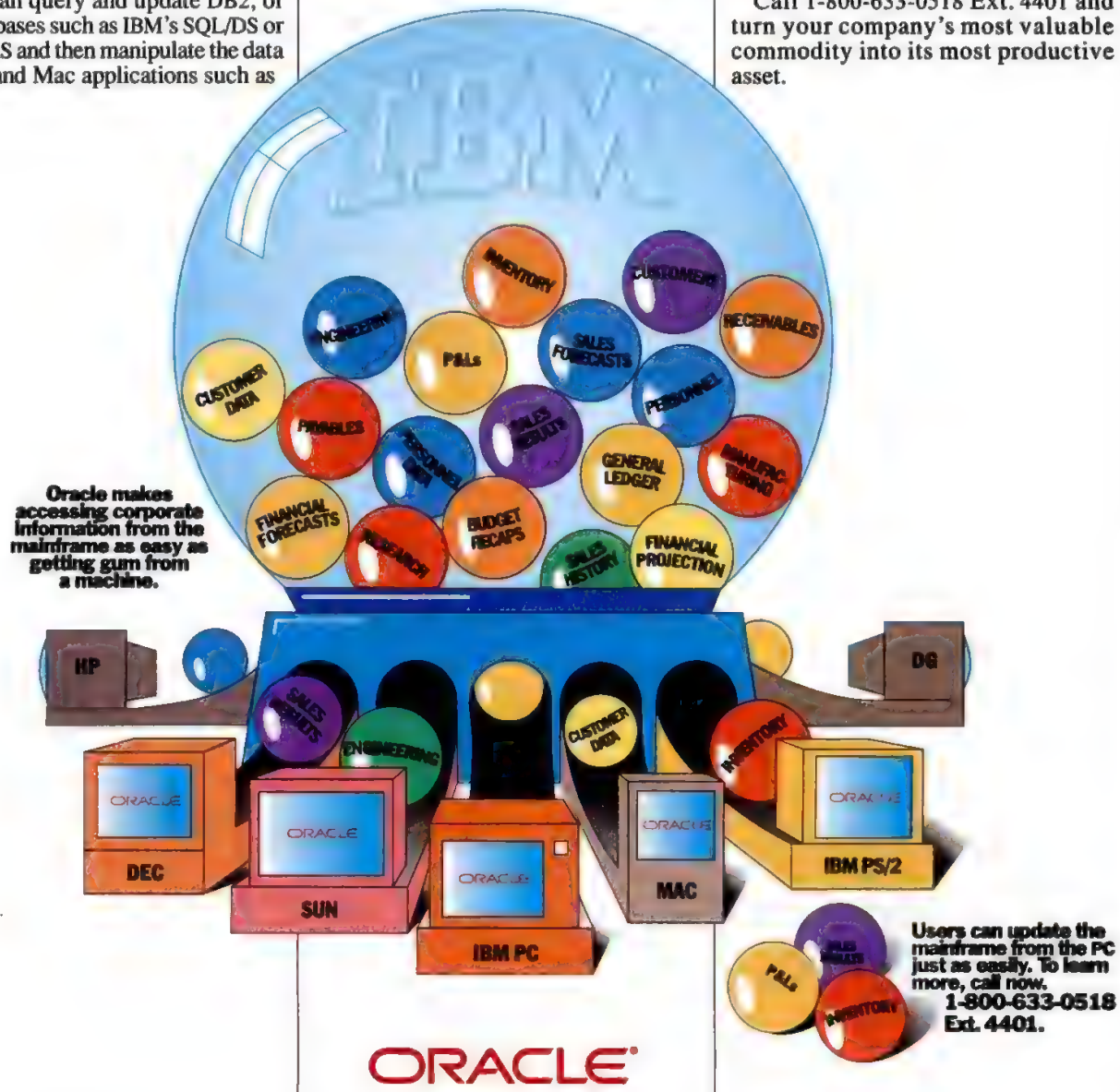

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William F. Zachmann

Looking Back: 1990 Retrospective

1990 was a rough year for Apple, NeXT, and IBM, but it was a great year for Will Zachmann, who predicted it here first. Look out Jimmy the Greek!

Nearly a year ago I made 13 predictions for 1990 (*PC Magazine*, January 16, 1990). They were deliberately structured to provide a commentary on what I expected to be key issues this year and their likely outcomes. What better way to end the year than to review those predictions?

First, the shift I predicted from an emphasis primarily on individual productivity applications to using personal computers (and micro technology generally) as building blocks for larger systems is clearly underway.

Replacing costly mainframe and minicomputer systems with micro-based alternatives, "downsizing," has become an important theme over the past 12 months. The word I first used back in 1985 has become a common one in the industry's vocabulary.

The significantly lower prices I predicted for 386-based systems, memory, PostScript printers, and other products have also come about as predicted. By early this fall, prices had fallen dramatically, making what only a year ago were expensive high-end systems affordable today for the majority of buyers.

My predictions about a takeoff for OS/2 and closing windows of opportunity for *Microsoft Windows*, however, did not fare very well in 1990. OS/2 use did not accelerate as I had thought it would, and the smashing success of *Windows* 3.0 rolled mercilessly over my prediction.

Unrepentant sinner that I am, I still think the move onward to OS/2 will come. I think I was just a bit ahead of my time. The renewed cooperation between IBM and Microsoft announced in September should help pave the way for OS/2. Still, I rate zeros on both these predictions for 1990.

My prediction that Unix would continue to go nowhere on the desktop, however, made it through the year with flying colors. For all the talk about Unix, and all the semi-fanatical enthusiasm on the part of its more zealous partisans, Unix market share on office PCs isn't much different from what it was a year ago.

That EISA would emerge as the dominant 32-bit bus standard for vendors other than IBM, and that MCA clones would go nowhere, also proved to be a correct prediction. MCA clones are all but a dead issue at this point, and EISA systems are now available from the majority of vendors other than IBM.

Another prediction that fared well this year was that at least some of the traditional PC software vendors would be in for a rough time. Ashton-Tate's difficulties were obvious to everyone, and once-mighty Lotus no longer leads the best-seller charts. The overall financial results for the established market leaders were generally disappointing.

I also said that IBM's OS/2 Extended Edition and *OfficeVision* would "tread water, at best." Score another hit there. EE has had only minor impact so far, and *OfficeVision* is reported to be in serious difficulty at this point.

My ninth prediction about 1990 being a "banner year for lawyers" was, of course, undeniably correct. There hasn't been a more litigious year in the industry in recent memory. Assertion of intellectual property rights seems to have become nearly as important as building and selling good products for a depressingly large number of vendors.

ILLUSTRATION: STEPHEN SWENY

The tenth prediction of big gains for network servers is arguably right or wrong depending on what aspects of the matter are emphasized. While sales of conspicuous products like Compaq's Systempro did not meet many people's expectations in 1990, a stunning array of vendors reading like a Who's Who in the industry introduced server prod-

ucts at a ferocious pace throughout 1990.

I also predicted a hard year for Apple. That has been borne out by two things. First is Apple's declining financial fortunes in the calendar year 1990. Also the denunciations of Apple's market strategy given at MacWorld Expo last August by the likes of Bill Campbell, then head of Apple's Claris subsidiary, have demonstrated Apple's serious marketing difficulties.

This fall's new product introductions by Apple are aimed at turning things around, but it remains to be seen how successful the company will be in doing so. Nevertheless, 1990 is not a year Apple would want to repeat.

While some diehards might want to argue the point, my prediction that "NeXT Isn't" also looks good. NeXT sales were poor through the first part of the year. The much-vaunted deal with Businessland did nothing for NeXT and nothing for Businessland.

NeXT responded to its dismal showing in the market with an improved product line, including color systems, this fall. So far, however, there is little convincing evidence that this latest (and probably last) effort is paying off, either.

Finally, I said that IBM's repeatedly anticipated turnaround won't come in 1990, either. We won't know for sure how that one turns out until IBM announces its fourth-quarter financial results in mid-January. Based on what we've seen thus far, however, it looks like my prediction will prove correct.

The bottom line, therefore, looks to me like eight correct, two wrong, at least for 1990 (OS/2 and *Windows*), two probables (NeXT and IBM), and one in between (network servers). That adds up to a win/lose/tie record of 8-2-3 which will go up to 10-2-1 if NeXT doesn't turn out to be the favorite stocking stuffer this holiday season and IBM's financial results in the current quarter are as dismal as I expect them to be.

CHANGING WAYS OF BUSINESS

Two events I didn't predict this year but wish I had may be even more interesting than the ones I did. The first is the spectacular growth of system vendors that sell direct. Vendors like Austin, CompuAdd, Dell, Gateway 2000, Northgate, Swan, TriStar, and Zeos have radically and probably permanently changed the distribution structure of the industry.

The second is the general decline of traditional computer storefront dealers. Unable to meet their promise of service and support to justify higher prices, they have seen their role reduced over the past year. Only those who truly add value through expertise— MicroAge is a good example—continue to do well.

In retrospect, 1990 is likely to prove to have been a key transitional year for the industry. A number of important issues that were unsettled and unsettling in 1990 appear on their way to resolution as 1991 approaches. Prospects are good for a solid resumption of growth in 1991, despite what may be unfavorable conditions in the economy generally. *That*, however, is a topic for my upcoming predictions for 1991. ■

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Memory: 1MB memory standard; expandable onboard to 5MB. 16MB system maximum.
Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive, OR 1.44MB, 3.5 inch, high density, double sided diskette drive. 40MB IDE hard drive.
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Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.
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Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive, OR 1.44MB, 3.5 inch, high density, double sided diskette drive. 200MB IDE hard drive.
Keyboard: 101-key enhanced layout.
Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.
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Memory: 4MB standard memory, expandable to 16MB of 32-bit memory.
Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive. AND 1.44MB, 3.5 inch, high density, double sided diskette drive. 200MB IDE hard drive.
Keyboard: 101-key enhanced layout.
Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.

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Microprocessor and Main Board: Intel 80486 running at either 8 or 25 MHz. Main board accepts a Weitek 4167 coprocessor to coexist with the 80486's built-in math coprocessor.
Memory: 4MB memory standard; expandable to 64MB of 64-bit memory.
Storage: 1.2MB, 5.25 inch, high density, double sided diskette drive. AND 1.44MB, 3.5 inch, high density, double sided diskette drive. 200 MB IDE hard drive.
Keyboard: 101-key enhanced layout.
Video: 16-bit VGA adapter with 256KB RAM, expandable to 512KB. 14 inch VGA monochrome display.
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Here's the short story.

33-MHz 386s

Mainstream Muscle

BY ALFRED POOR

As 1990 winds down, we can look back on a big year in the PC marketplace. Memory prices went down, 80486 systems began to appear in quantity, hard disks got bigger, faster, and cheaper, and *Microsoft Windows* 3.0 gave us all a reason to want more in—and from—our PCs. No wonder, then, that this was the year that saw the 33-MHz 386 taking over as the mainstream power machine, leaving 486 systems to make their mark as very high-end engineering, scientific, and graphics-intensive workstations.

The demand for 33-MHz 386 PCs seems confirmed by the sheer number of vendors selling these systems. It seems that there are more machines at this level than at any other in the PC hierarchy. In this issue, we take a look at 45 computers with 33-MHz 386 brains. If you think that's an impressive figure, you'll really be astonished to find that it doesn't begin to include all the 33-MHz 386 systems in existence. In the October 31, 1989 issue, we covered 22 computers in this class, and in the February 13, 1990 issue, we reviewed another batch of 22. *None* of the machines represented in those two reviews are included in this roundup—that means you can ponder yet another 45 machines before you buy. (Watch for a near-future issue examining the 33-MHz 386s that have been significantly updated by their manufacturers since the October and February reviews.)

Once the machine for the most high-end applications, and still a good choice for network servers, the 33-MHz 386 is also moving down to the mainstream power user's desktop.

REVIEW CRITERIA

Add to the above list two machines from well-known manufacturers that were not included in this round-up. Tandy failed to get an evaluation unit to us before our deadline, and Arche sent a machine that was too different from the test specification—a 150MB hard disk, 4MB of RAM, a 64K RAM cache, one floppy drive, and DOS 3.3 or 4.0—to be included. We made allowances only for *minor* variations from the requested specification—for instance, machines that came in with hard disks ranging from 120MB to 200MB, or those that came with smaller RAM caches were fit for inclusion.

The final list included systems from ACMA, AGI, ARC, Argo, ACT, Bitwise Designs, Blue Star, Brain, BSI, CAF, Clone, CompuAdd, Computer Marketplace, Core, CSR, DEC, Dynamic Decisions, EPS, Everest, Fortron, GRiD, Hertz, Hyundai, Insight, Master Computer, Matrix, Memorex, Micro Telesis, Mitsuba, MultiMicro, Novacor, Peregrine, Premier, PSG, Quill, SAI, Swan, Tandon, Tatung, Televideo, Tenex, Texas Micro Systems, Transource, Unisys, and Wang.

BUYING DECISIONS

In the crowded PC field, the 16- and 20-MHz SX models own the entry-level layers, and the 486 systems get bragging rights for having the most technically advanced processor. But unless you rely on applications that can make use of the 486 chip's built-in math coprocessor capabilities, such as the ones mentioned earlier, or unless you must have the latest and greatest design around, you'll find that the 33-MHz 386 gives you the most bang for your buck. (See the sidebar "The 386-33: Today's Best Buy.")

The wide range of 386/33 machines available leads to a buyer's dilemma: what criteria do you use for selecting one system out of almost 100? It would be a mistake to use the systems' results on our benchmark tests as your only guide—we found that one 33-MHz 386 machine performs pretty much the same as the other 33-MHz 386 machines. Aside from a few stragglers at the bottom of the pack, there was less than a 10 percent difference on the 80386 Instruction Mix test results between the slower machines reviewed here and their faster counterparts. Interestingly, these fast systems, which we tested with BIOS shadowing turned on, didn't do drastically better on this test than the 386/33s reviewed without BIOS shadowing enabled in our previous two roundups. The best score here was 1.59; compare that to the 1.63 and 1.61 Instruction Mix times racked up by machines in the October and February reviews, respectively.

Among the systems reviewed here, there were more significant differences in the hard disk and video times, but since those results are at least as dependent on the components used as they are on the motherboard design, you can generally increase performance by opting for better parts. A traditional ST-506 MFM drive was sufficient for older 8088 and 80286 systems, but a 386/33 can support faster components. ESDI, SCSI, and IDE interfaces are in use among these machines, with ESDI being the most popular. Additionally, part of the CompuAdd machine's integral design is its disk controller with cache memory—a factor that no doubt played a large part in the system's excellent performance on our PC Labs' Disk Benchmark test.

All the 33-MHz 386s reviewed in this issue, and in the two previous, boasted a processor RAM cache, usually 32K or 64K. The system cache speeds performance by storing information in fast static RAM, so the CPU rarely has to wait for a refresh cycle before fetching information from memory. This design is typically behind a vendor's claim of "zero wait state" operation. Perhaps not surprisingly, the three top performers reviewed here boasted 64K caches; the three slowest, only 32K—again, though, the spread is so slight that you shouldn't make your pur-

EDITOR'S CHOICE

• CompuAdd 333T

CompuAdd wins Editor's Choice for its superb combination of performance, expandability, and service. Normally, we steer away from awarding a product Editor's Choice just because it performs well: In almost all cases, the scores are so tightly packed that the differences are virtually meaningless. However, CompuAdd has built this system for speed. The company uses 640K of static RAM as the conventional memory of its 333T, which makes the machine the fastest in its class.

CompuAdd adds great value to its package. You'll get a full year of on-site service, and the assurance of an FCC Class B rating, which makes it an excellent choice as a power user's home machine. Finally, this system offers top-notch expandability. Nine slots come inside the full-sized tower case, and CompuAdd builds three I/O ports into the motherboard, instead of wasting a slot. For the best value in an intelligently designed PC, CompuAdd is worth the investment.

Hertz and Hyundai are both worth investigating, as well, and qualify for honorable mentions. For hazardous duty in the network war zone, the Hertz 386/33i has what it takes: huge drive and expansion board capacity, and armor plating against the worst offenses office workers can muster. This FCC Class B system's Intel motherboard comes with ten slots, four half-height, and two full-height drive bays.

The Hyundai Super-386T will change what you think about Korea's premiere industrial giant. Hyundai is now selling a well-made, top-performing American PC. Available through computer dealers, it comes with an 18-month warranty on parts and labor. Quality and performance rank it among the best.

Before making any final decisions, however, you may want to wait for our next issue, where we will review another 26 33-MHz 386s from the following vendors: Amax, Arche, Austin, Blackship, Boss, Bus, Club American Technologies, Dataworld, Dell, Destiny, DTK, DynaMicro, Everex, Gateway, Micro Express, National MicroSystems, PC Brand, PC Craft, PC Max, Polywell, Spear, Tandy, Tangent, Tri-Star, Zeos, and Zodiac.

chase based solely on these numbers.

The PC marketplace, and the 33-MHz 386 arena in particular, has become so crowded that a competitive price is almost assumed as a given requirement by the buyers—of course, the definition of a competitive price varies depending on whether you're speaking about a brand name product versus a clone, or a retail product versus a direct-marketed machine. Your decisions will most likely be based on factors such as what you plan to do with the system, the vendor's warranty and support, and the extras included.

Determining the use to which the system will be put is the first step. The 33-MHz 386 that you want to use as a file server for your network certainly has different memory and storage expansion requirements than does the machine destined to run large spreadsheets, or the one to be used for stand-alone database applications. Most mail-order vendors stand ready with an à la carte approach, offering you a zillion possible combinations of different cases, hard drives, displays, and memory configurations. Some other vendors are more inflexible in their offerings, with only a few hard disk options defining your choices. Your job is to make certain that you can get your system outfitted with the mix of components that you need.

Many vendors today seek to differentiate their products through service features; this is as true of the 33-MHz 386 as it is of most products in a company's line. Some offer free technical support as long as you own the computer; others provide 24-hour-a-day phone support. Many use either their own dedicated electronic bulletin board system (BBS) or a national service such as CompuServe to post technical information and answer common questions. Of course, there are still those who offer little or no technical support services—in these cases you typically trade support for lower prices.

OUR CONTRIBUTORS

Bruce Brown, Mitt Jones, Bill O'Brien, Al Poor, Winn L. Rosch, and M. David Stone are contributing editors of *PC Magazine*.
Fredric Burke, Robert Kendall, and John R. Quain are frequent contributors to *PC Magazine*.
Susan Langford Jones is an economist and a builder of analytical marketing systems.

Repair policies also vary widely. Some vendors still require that you ship the machine back to them for repair, but many have discovered that buyers want faster and more convenient service. As a result, you will find more on-site service contracts bundled with systems, or provisions for shipping you parts overnight without waiting for the broken component to be received.

THE WINDOWS EDGE

Many of these vendors seek an edge by bundling more goodies with their systems than the competition. In the past, this has been limited to utilities such as backup and video programs, and the odd piece of hardware like a mouse that comes with the display adapter card. With last summer's release of *Windows* 3.0, however, the field has changed. Microsoft has made it nearly irresistible to 386/33 vendors to bundle *Windows*; but the catch is that Microsoft makes it part of the deal that the program be bundled with all the vendor's machines of that model.

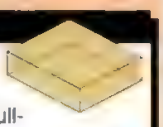
Some vendors have taken Microsoft's deal and made it even better for the buyer. Since the *Windows* bundle includes DOS and a mouse as well, some vendors opt to install DOS and *Windows* on the hard disk. With the system configured for you, all you have to do is take the machine out of its shipping cart and plug it in. You'll be up and running in record time. The best part of the *Windows* deal is that some vendors offer it at prices comparable to systems that don't include it.

Finally, the documentation delivered with a PC can be an important element in the decision-making process. The only ones who won't care so much about well-written documentation are the experienced power users familiar with the insides of PCs in general—people who have no qualms about identifying video cards and hard disk cable attachments just by looking inside. However, there are many users out there who, however experienced they may be with software, get lost when it comes to troubleshooting poorly documented hardware. As the 386/33 moves forward into the mainstream market, it's going to be showing up on the desks of a lot more of the less-savvy users—people who will benefit from the extra effort made by vendors who don't just throw in a collection of pamphlets provided by the manufacturers of components like the motherboard, I/O card, video adapter, disk controller, and hard disk. If a stack of stray papers filled with technobabble doesn't intimidate you or the users you buy for, then you may get away with spending a lot less money. If it does, then your real savings may come by investing in a well-documented machine in the first place. As a general rule, the bigger the vendor, the better documented the system.

Whether you opt for an inexpensive machine that doesn't have a lot of service options or come with complete documentation, or you prefer a system with the works, rest assured that you will be picking a PC that makes sense as the practical business system in today's market. In less than a year and a half, 386/33 systems have gone from being an expensive hot-shot rarity to an affordable and commonplace workhorse ready to churn out your tasks. No longer an extravagance, this is the level of machine to pick if you need full power in a business computer.

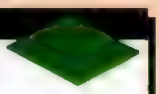
INTERIOR CONFIGURATION KEY

CASE



Cases typically come in five sizes: full desktop (shown here), full-height small-footprint, half-height small-footprint, tower, and mini-tower.

MOTHERBOARD

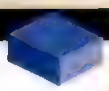


Motherboards come in a wide variety of sizes.

EXPANSION BOARD SLOTS

For the purpose of these diagrams, all slots are represented by full-size boards.

POWER SUPPLY



Power supply options fall into four categories: large (shown here), medium, small, and long and narrow.

DRIVE BAY

Drive bays typically come in four different sizes: full-height (shown here), half-height, one-third-height, and 3.5-inch size.

ACMA Computers Inc.

ACMA 386/33 Corporate Workstation

by Bruce Brown

If you're in the market for a plain-vanilla single-user computer, the ACMA 386/33 Corporate Workstation may be exactly what you want. Reasonably priced, the FCC Class A full-size desktop machine offers the requisite number of expansion slots and bays, and registers acceptable but not astounding benchmark test scores.

The list price for the standard (and tested) configuration is $3,295, one of the lower quotes for fully equipped machines in this issue. The system came with 4MB of 70-nanosecond RAM, a 64K RAM cache, an NEC 157MB 18-millisecond ESDI hard disk with the Ultrastor 32K buffer combination hard and floppy disk drive controller, and both 1.2MB and 1.44MB TEAC floppy disk drives. The video system consists of Helm Engineering's Impression 512K RAM 1,024-by-768 video adapter with a Western Digital/Paradise video chip set and a dual voltage (110/220) Impression Super VGA interlaced 1,024-by-768 color monitor. Other standard configuration features include a 101-key MaxiSwitch keyboard, two serial ports, one parallel port, and one game port, and DOS 4.01 (DOS 3.3 can be substituted, instead).

FACT FILE

ACMA 386/33 Corporate Workstation
ACMA Computers Inc., 117 Fourier Ave., Fremont, CA 94539; (800) 456-1818, (415) 623-1212.
List Price: With 2MB RAM, 60MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA video adapter, Super VGA color display, one parallel port, one game port, two serial ports, DOS 3.3 or 4.01, $2,555; with 4MB RAM, 106MB hard disk, $2,995; as tested with 157MB hard disk, $3,295.
In Short: The ACMA Corporate Workstation is a solid value with good components, average performance, and a very nice price. Recommended for standalone computer needs but probably not as a file server where more drive bays and faster performance matter.

CIRCLE 429 ON READER SERVICE CARD

The Corporate Workstation employs ACMA's own motherboard with a wired-in discrete logic 386 chip set and the AMI ROM BIOS. This motherboard does not support video or ROM BIOS shadowing. The cache is also controlled by discrete motherboard logic circuitry, and makes use of 25-ns. 64-kilobit SRAM memory chips. The cache size is not expandable, though this should not be considered a limitation since anything greater than an 8K cache often yields no significant performance increase with standard DOS applications. The ACMA motherboard has a single math coprocessor socket that can take either an Intel 80387 33-MHz or Weitek 3167 33-MHz unit, but not both.

The Corporate Workstation can take up to 8MB on the motherboard using 256Kb or 1MB SIMM modules in an interleaved page-mode memory configuration. If you want to expand to the system's maximum 16MB RAM, a $150 proprietary 32-bit memory board can hold an additional 8MB of RAM, currently priced at $100 per megabyte.

CORPORATE BEIGE

The Corporate Workstation's fairly standard AT-style desktop case measures 6.5 by 21 by 16.8 inches (HWD). The power switch is on the right side and the reset button and combination case and keyboard lock are on the front. The drive chassis holds up to five half-height 5.25-inch floppy disk drives (with three able to use removable media storage devices). The 200-watt Taiwan Litton Electronic power supply has power leads for only four drives.

There are eight expansion slots in the ACMA machine, one 8-bit, six 16-bit, and the last serving double duty either for the 32-bit memory expansion board or a standard 16-bit interface board. The test machine used the 8-bit slot for an I/O board and two 16-bit slots for the video and drive controller boards, leaving five slots free.

The ACMA machine is an average performer in an overall speedy group, with processor scores landing on the low end of the mid-range, but the memory score falling on the high side of average. Drive scores varied in a similar manner, with the unit garnering average DOS File Access test scores on the small-record test, and above average results on the large-record test. The BIOS Disk Seek scores were just below average, but true to the ESDI hard drive's 18-ms. rate. The Direct to Screen video score landed right at the median point of the tested range; Video BIOS with and without scrolling marks were slightly below average.

ACMA 386/33 Corporate Workstation, $3,295

ACMA sells computers via mail order and telephone order only. The company provides a one-year warranty on parts and two years on labor for all systems. There is no standard on-site service contract, although an option to secure Memorex/Telex as the service provider is available. If you buy a system and have a problem, ACMA supplies unlimited toll-free technical support and will ship replacement parts via air freight. If you and its technical staff can't solve the problem via telephone, ACMA will pay return shipping costs by whatever method you use to send the computer to its California location. To top it all off, ACMA offers a better-than-average 45-day money-back guarantee.

It's not the fastest machine around, nor the most expandable, but ACMA's 386/33 Corporate Workstation performs up to expectations, and sells for a decent price. Standard on-site service would make the 386/33 more competitive with other machines from mail-order vendors, but otherwise this machine gives you solid value for your dollar.

AGI Computer Inc.

AGI 3900B

by Bruce Brown

AGI is a wholly owned subsidiary of Everex Computer Systems, but don't think its 3900B is another Everex Step machine—the AGI systems are designed and manufactured separately from the parent organization's other lines. Sold primarily

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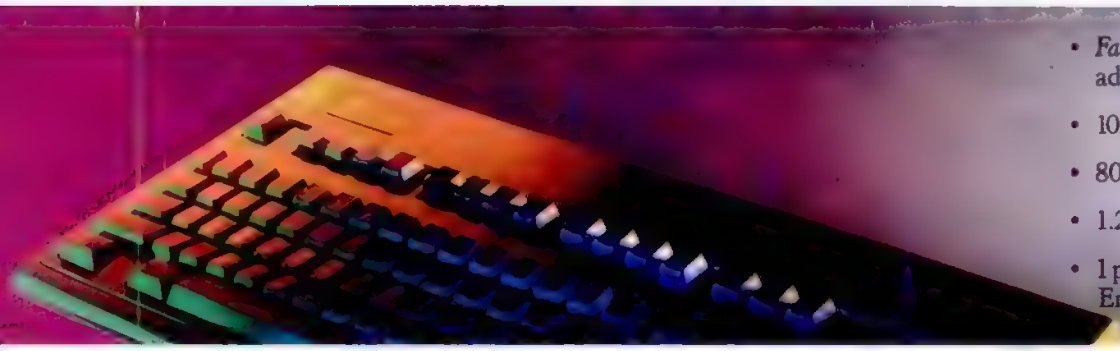

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The 386/25i and 386/33i are designed around a genuine Intel main system board. These systems incorporate the finest components including 64K cache memory.

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These 386 and 486 systems include a Conner 100MB IDE hard drive as standard equipment. You can have virtually any drive you want from 40MB up to 600MB in IDE or ESDI formats from the industry's top manufacturers like Conner and Micropolis.

And all desktop units are equipped standard with both 1.2MB and 1.44MB floppy drives; 101-key enhanced keyboard; 2 serial/1 parallel ports; heavy duty steel case; 5 half-height drive bays; 200 watt power supply; LIM EMS 4.0 drivers; FCC class B certification and FREE 1 year TRW on-site service.

We can also add an optional 120MB or 500MB tape drive, if you like.

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386/25MHz PORTACOMP III $2,955
SUPER VGA/4MB RAM/100MB HD

The PORTACOMP uses a VGA gas plasma (640 x 480 with 16 gray scales) display that delivers sharp clear screens even under severe lighting conditions. It also supports an external color VGA monitor simultaneously.

Its full function keyboard and two full-sized expansion slots mean this mobile system can be upgraded for just about any application.

These systems are standard with 1MB memory (expandable to 8MB); 40MB Conner IDE hard drive (optional up to 200MB); 1.44MB 3.5" floppy drives (or optional 1.2MB floppy) and 101-key enhanced keyboard with separate numeric and cursor keys; 2 serial/1 parallel ports; 2 full-length 16-bit ISA expansion slots; carrying case; and 150 watt power supply (110/220V auto-switching).

PC MAGAZINE
Endurance Tests Data 386/25A—Jan 16, 1990

PC MAGAZINE EDITORS' CHOICE
Data 386/25 May 30, 1989

PC MAGAZINE EDITORS' CHOICE
Data 386/20 May 30, 1989

PC MAGAZINE EDITORS' CHOICE
Data 386/16 Feb 28, 1989

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Recently, the editors at InfoWorld magazine compared our new portable laptop LP-320 (setup value $3,025) to Compaq's Portable 386 (setup value $8,997) and Toshiba's T5200 (setup value $8,497). Here's some of what InfoWorld said,

1) **Speed: "DataWorld's disk-intensive total was the best."**
2) **Screen: "VGA-compatible screen that has a dark-and-bold font that is unusually sharp."**
3) **Battery: "No other system in this comparison (Compaq nor Toshiba) supports a battery."**
4) **Support: "Helpful technicians who accurately answered our questions."**
5) **Value: "The DataWorld system is a great value. This is a solid buy."**

INFO WORLD "Bustin' Out" Sept 3, 1990

LP/320 SUPER VGA/1MB RAM/43MB HD $2,650
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When we began to design the LP-320 we asked our customers what they thought was a good deal and we'd make it.

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We started with a genuine Intel 386 20MHz 32-bit processor, a sharp LCD VGA super-twist screen that offers high contrast 640 x 480 normal or reverse video display, 80387 coprocessor support, 1MB RAM that's expandable to 8MB, a Conner 43MB 25ms IDE built-in hard drive (you can choose an optional 100 or 200 megabyte drive!), a 3.5" 1.44MB floppy, 1 parallel, 2 serial ports, and 1 expansion slot, and we put it all in an attractive solid case strong enough to go on the road.

And, because we believe the concept of a laptop demands portability we added a built-in rechargeable battery, so you can take them anywhere and work comfortably. We also added a separate numeric keypad, an AC adapter and carrying bag as standard equipment. And you can add a few nice options like serial mouse, full desktop size VGA monitor, an internal modem, a 5.25" external floppy and even a 120MB tape back-up.

When we showed the first prototype model of the LP-320 everyone agreed that the LP-320 is no ordinary laptop. It's made for users who value advanced technology and top performance—and for users who appreciate extra special touches that other laptops don't have, such as number keys and a sleep mode that extends the battery life.

And since laptops have to conform to the same laws of government and nature as larger desktops, our LP-320 offers the security of FCC class B certification and FREE 1 year TRW on-site service as well.

Of course, with a laptop this good you'd expect it to be the most expensive.

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That's the best part. While the Compaq Portable 386 and Toshiba T5200 are priced over $8,000 each (and they don't have battery support or numeric keypad), we priced the LP-320 at an incredible $2,650, complete!

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DATAWORLD

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FACT FILE

AGI 3900B
AGI Computer Inc., 48630 Milmont Dr., Fremont, CA 94538; (800) 322-3840, (415) 683-2200.
List Price: With 4MB RAM, 1.2MB floppy disk drive, ESDI floppy/hard disk drive controller, one parallel and two serial ports, $5,500; with 4MB RAM, 158MB hard disk, Super VGA video adapter, Super VGA color display, DOS 4.01, $7,438.
In Short: The AGI 3900B is a full-size tower machine suitable for use as a file server or an individual, especially for someone who needs lots of drives. Sold only through consultants and VARs who often set up full systems and networks, the AGI machine's fine performance and solid construction somewhat offset the higher-than-average list price, especially since hefty discounts are often available.

CIRCLE 542 ON READER SERVICE CARD

through consultants and VARs, the AGI 3900B is a beautifully made, large-tower-based system that even includes an excellent manual.

At $7,438 for the standard configuration, this computer certainly isn't inexpensive, but discounts of 25 to 35 percent are probably available. The standard configuration, which is identical to the one we tested, includes 4MB RAM, 64K processor RAM cache, a 158MB 14-millisecond Maxtor ESDI hard drive with an Everex ESDI controller, a TEAC 1.2MB floppy disk drive, and an Everex Viewpoint 512K Super VGA display adapter with the Tseng ET4000 chip set. A 14-inch color multisynchronous Eversion Monitor 300, featuring a 0.28-millimeter dot mask and up to 1,024-by-768 interlaced performance, completes the display system. Other components include a 101-key Key Tronic keyboard with 12 function keys, two serial ports, one parallel port, and DOS 4.01.

Designed by AGI's engineers, the motherboard incorporates discrete logic for both the 386 instruction set and the write-back processor RAM cache. The RAM cache comes in just one size, 64K, and makes use of 20-nanosecond SRAM DIP chips.

You can set the system to run at 8, 12, or 33 MHz if you wish, and you can separately set the bus speed to 8.25 (the safest), 12.5, or 16.5 MHz. The ROM BIOS on the AGI machine uses AMI chips and includes selectable system ROM BIOS shadowing, but won't shadow video BIOS instructions (not a loss since the video times are great). The motherboard can handle either an Intel 80387 33-MHz or Weitek 3167 math coprocessor chip, but not both.

The motherboard holds up to 8MB of interleaved page-mode memory using 1MB SIMM modules rated at just 100 ns., but that didn't seem to hamper the machine's performance on our memory benchmark test. To expand your system beyond 8MB, you need to invest in a $280 memory card and then buy standard memory modules through your dealer or consultant.

The AGI 3900B scored consistently well on the PC Labs benchmark tests, with average to better than average scores on the processor and memory tests. The DOS File Access (Small Records) test was a bit below average, but the large record test and BIOS Disk Seek test scores were in the middle of the pack. The video Direct to Screen test and Video BIOS Routine with Scrolling test scores were among the very top, although the Video BIOS Without Scrolling test score was only in the middle-range of machines tested in this review.

> The AGI 3900B is a well-made system with good test scores. It begs to be loaded with huge disk drives and to be used as a file server.

The massive AGI tower-style case measures 26 by 7 by 18.5 inches. If you extend the system support feet, the width increases to 12.5 inches, but only at the very bottom. The keyboard lock, power switch, and reset button are all on the front of the case. Inside the case the frame and drive chassis are very solid. An added measure of the case's quality is its FCC Class B rating.

ROOM FOR EXPANSION

The AGI 3900B has room for loads of storage devices. Four half-height 5.25-inch drives, each with the potential of handling removable media devices, can be stacked in front. Two full-height (or, if you prefer, two more half-height 5.25-inch) drives also can be installed internally, one right behind the other in the midsection of the case.

To power a fully loaded system, the AGI computer has a Skynet Electronics 250-watt power supply with dual voltage and a full complement of six device power leads. A full case generates a good deal of heat in the course of a day's work, so there's a bottom front intake fan to work with the exhaust fan that's part of the top-back-mounted power supply.

AGI 3900B, $7,438

The AGI 3900B's set of expansion slots is the norm for this class, with one 8-bit slot and six 16-bit slots, as well as a 32-bit slot for the optional proprietary memory card.

While AGI Computer sells systems solely to distributors, who in turn sell them to the VARs, VADs, and consultants, AGI machines—though not this particular system—have been advertised in such places as a Crutchfield Personal Office catalog. All computers made by AGI come with a standard one-year parts and labor warranty with service provided through dealers. An extended warranty and optional on-site service are available, but the way they're generally sold dictates that the consultants and VARs are the ones who will be primarily responsible for system support and service should you have a problem.

The size and drive room of the AGI 3900B suggest its use as a file server or multiuser computer. The price is fairly hefty, but then you're almost sure to get hefty discounts, probably without even asking. This well-made system with good test scores is just begging to be loaded with huge disk drives.

American Research Corp.

ARC 386/33 Skyscraper

by Bruce Brown

As its name implies, American Research Corp.'s ARC 386/33 Skyscraper is a full-size tower-style machine, measuring 23.8 by 6.5 by 19 inches. However, it offers only average expansion room for a desktop and only average performance; it's the competitive price and the company's standard on-site service that make it worthy of attention.

Our test system, configured to the *PC Magazine* standard for this class, costs $3,575. Components include 4MB RAM, a 64K processor RAM cache, a 137MB 15-millisecond Seagate SCSI drive with a Future Domain SCSI drive controller, and 1.2MB and 1.44MB TEAC floppy disk drives. The video card is a 16-bit Super VGA 1,024-by-768 interlaced capable unit with a Western Digital/Paradise video chip set that is paired with a Samsung CM4551 0.31-millimeter dot-mask, 14-inch, 800-by-600 color Super VGA monitor. The system also includes ARC's own 101-key keyboard with a 60-inch cable, a 60-inch extension cable, two serial ports, one parallel port, DOS 4.01, *Windows* 3.0, and a Microsoft serial mouse.

The Skyscraper, which can run at either 8 MHz or 33 MHz, was a below average performer on the PC Labs benchmark tests. The processor times were above average but the memory speed test score fell at the bottom of the group; it took 0.36 seconds compared with the median 0.31 seconds in the Conventional Memory test. Relative to the drives in the other units, the hard disk times were all fairly slow. The video scores produced mixed, but overall slightly below average, results.

ARC 386/33 Skyscraper, $3,575

ARC uses its own motherboard, including discrete 386 instruction circuitry and the company's own cache controller. The ROM BIOS is by AMI. Both video and system ROM BIOS shadowing can be selected independently via the CMOS setup utility. The system provides for both an 80387 33-MHz math coprocessor and a Weitek 3167 unit.

The processor RAM cache is equipped with 25-nanosecond, 64K SRAM DIP chips, and can be expanded to 128K if specified. The ARC can provide for a full 16MB of processor RAM on the motherboard using 80-ns. SIMM module chips for the interleaved page-mode memory architecture.

LESS THAN TOWERING DRIVE CAPACITY

Power, turbo, and reset switches and buttons are all on the front of the case. To help cool the Skyscraper's interior, the case includes an intake fan located at the bottom front to work in conjunction with the 200-watt top-rear-mounted power supply's exhaust fan.

The drive expansion setup on the FCC Class A–rated Skyscraper is a bit unusual, though acceptable for a single-user machine. For drives with removable media there are two exposed front 3.5-inch and two 5.25-inch half-height bays. There's also an interior bay that can hold one full-height or two half-height drives. The machine's ability to accommodate six devices is about two short of what you might expect from a tower-size system being positioned as a file server. Additionally, the power supply comes with only four device leads, which you'll have to augment with power splitters if necessary. There are eight expansion slots, two 8-bit and six 16-bit; five were free in the review machine.

ARC sells computers through dealers, a direct sales force, and VARs, as well as via mail order. Its systems come with a one-year parts-and-labor warranty and standard on-site service via Video Aid Corp.

The Skyscraper's on-site service and 16MB-capable motherboard are definite pluses, but its lackluster performance and middling drive expansion space keep the system from earning a recommendation as a file server. It may function better as a single user's machine, particularly if that user is more interested in price than performance.

FACT FILE

ARC 386/33 Skyscraper. American Research Corp., 1101 Monterey Pass Rd., Monterey Park, CA 91754; (800) 346-3272, (213) 265-0835.
List Price: With 2MB RAM, 1.2MB or 1.44MB floppy disk drive, IDE drive interface, one parallel and two serial ports, DOS 4.01, $1,968; with 4MB RAM, 137MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA color display, *Windows* 3.0, and Microsoft Mouse, $3,575.
In Short: As its name implies, the ARC 386/33 Skyscraper is a tall tower computer. It has average performance and expansion room, includes on-site service, and sells for a decent price. Although it's a large machine, it's better suited for a single user rather than network server use.

CIRCLE 543 ON READER SERVICE CARD

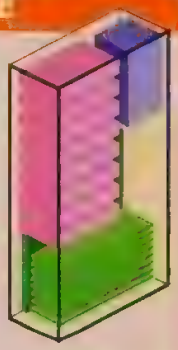
Argo Computers Inc.

Argo Tower 386/33

by Bruce Brown

The Argo Tower 386/33 is a full-size tower case machine with loads of drive room and solid performance, making it an

FACT FILE



Argo Tower 386/33 Argo Computers Inc., 220 South Rock Blvd., #9, Reno, NV 89502; (800) 456-3837, (702) 324-7070.
List Price: With 4MB RAM, 60MB hard disk, 1.2MB floppy disk drive, Super VGA 512K video adapter, Super VGA color display, one parallel and two serial ports, DOS 3.3 or 4.01, $2,799; with 179MB hard disk, 1MB video adapter, upgraded Sony 1,024-by-768 monitor, $3,534; with two floppy disk drives, Logitech mouse, $3,652.
In Short: Argo's tower case 33-MHz machine is suitable for network file server use thanks to its eight drive bays. Overall, the system's performance is average for the class except for the top video scores owing to the Orchid Prodesigner II video card with 1MB video RAM. And the price is certainly right.

CIRCLE 544 ON READER SERVICE CARD

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33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Price of tested configuration For 33-MHz 386 computers, our standard tested configuration includes 4MB RAM, a 150MB hard disk, a 64K RAM cache, one high-density floppy disk drive, a color VGA video display, at least one parallel and one serial port, a keyboard, and DOS.

In some instances, manufacturers do not offer the exact configuration *PC Magazine* requested, but all 45 PCs reviewed here provide a reasonably close match for this list of requirements. Check each machine's fact file for a more exact indication of what is included at the quoted price.

Distribution channel Some machines are sold directly through mail order. When machines are sold by dealers, the purchaser may find discounts of 25 percent or more off the list price (although there is no guarantee that the discounts will run this high).

Case type indicates whether each computer has a small-footprint, desktop, tower, mini-tower, or rack-mount design.

386 chip set manufacturer indicates which company makes the support logic that connects the CPU with the other functions managed by the system board. Chip sets that employ VLSI (very large-scale integration) technology reduce the discrete component count, which in turn helps to reduce power consumption and increase component life. In some cases the computer uses discrete logic rather than a chip set.

The **system RAM arrangement** is the method in which memory is addressed. The design of system RAM aims at avoiding the wait states imposed when CPU speed outpaces conventional memory speed.

Interleaved memory increases processing speed by dividing the memory into two or four portions that process information alternately. The CPU sends information to one section for processing while another section goes through a refresh cycle.

Page-mode memory allows back-to-back memory accesses within blocks of memory called pages, avoiding wait states.

Row/column is the traditional method of accessing data at a memory address. RAM is mapped as a matrix, and a particular address is given using a row and a column number.

Wait states On the average, most machines run at between zero and one wait state. The figures printed here were supplied by the respective manufacturers.

Maximum installable 32-bit RAM Separate rows indicate the maximum 32-bit memory possible on the motherboard and on a dedicated memory board.

RAM packaging (and rated speed) Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs.

The *dual in-line package (DIP)* is the traditional buglike computer chip sprouting 8, 14, 24, 40, or more metal legs (evenly divided between right and left sides).

Single in-line packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. They can be individual chips or multiple chips on a small card, with a proprietary SIP connection.

Single in-line memory modules (SIMMs) consist of individual logic devices installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement facilitates easy installation and replacement.

Installed chip size Kb and Mb refer to kilobits and megabits, respectively. Combination chips (4x256Kb) are generally faster and more expensive.

The **BIOS version and date** can affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version may encounter some variations in performance.

Setup can reside either on a floppy disk or in ROM.

Shadowing Shadow RAM is a technology that loads video BIOS and/or system BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed. It uses a segment of system memory located between the boundary of conventional memory (640K) and the end of the first megabyte of installed RAM. The ability to disable shadowing is important with some applications to resolve memory conflicts.

Hard disk interface Within the 386 PC environment, the most common hard disk interfaces are *IDE (integrated drive electronics), SCSI (small computer system interface)*, and *ESDI (enhanced small device interface)*. With an IDE interface the drive contains its own controller electronics; by contrast, each non-IDE computer in this roundup has a disk controller on a card. IDE can offer good performance at a lower price than ESDI or SCSI.

Fading from popularity is the *RLL (run length limited)* interface, a data encoding technique that is more efficient in packing bits than the older MFM method.

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available. We are listing what we believe are the most popular disk choices (40MB, 60MB, 80MB, 100MB, 150MB, 200MB, 300MB, 600MB, or the vendors' closest available models).

Bus speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz.

The **display circuitry** can be either on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled it prevents upgrades.

Interface 16-bit video interfaces are typically faster than 8-bit because of their wider bandwidth.

Software available The availability and price of DOS 3.3 and 4.01 are listed here. If no price is shown, the base-priced system includes DOS. (*PC Magazine*'s standard configuration includes DOS 4.01—or, if it is not available, DOS 3.3—to allow more accurate price comparisons.)

Where OS/2 is available, the version number and list price are provided. Other software is listed as available if it is bundled free of charge or at a nominal cost.

Disk caching software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

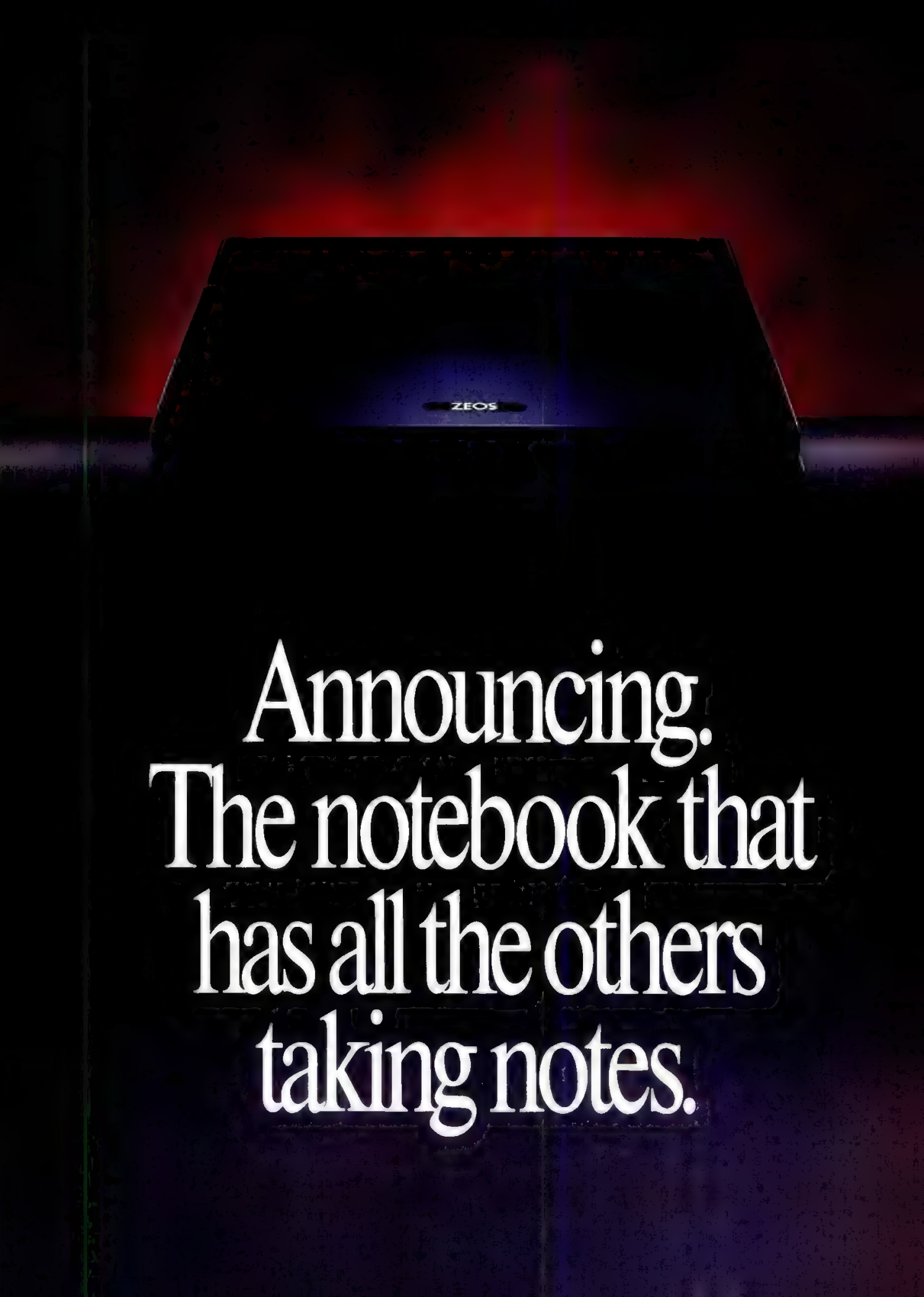
An **expanded memory manager** is software that emulates the Lotus/Intel/Microsoft (LIM) expanded memory manager within the extended memory of a 386 PC.

Dual voltage on the power supply permits a computer's use in both the United States and Europe.

Number of device connectors indicates how many internal storage devices the system can support without the use of Y cables (power splitters).

FCC Class B certification Two classes of FCC (Federal Communications Commission) approval, Class A and Class B, may be given to computers. Class A approval signifies that a computer has sufficiently low radio-frequency emissions for operation in a business locale. The more stringent Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

CONTINUES


ZEOS
Announcing.
The notebook that
has all the others
taking notes.

ZEOS NOTEBOOK 286

The ZEOS® Notebook:

80286, Hard Drive, Floppy drive, VGA, Under 7 lbs., Beautiful!

And The Price?

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EBOOK '286

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Either way, you're sure to appreciate our light weight snap-in, snap-out battery packs. They're so light and easy to use, you can easily take an extra one with you on those really long trips. Plus, you can get even more life out of a single charge by using our programmable power management system. Hour upon hour of Notebook computing power!

CONNECTIVITY TOO!

Your new ZEOS notebook is a great connectivity tool. Utilizing our optional built-in 2400 baud MNP Class 5 modem, connectivity buffs will find themselves logging on at every turn. And speaking of connectivity, we've kept the I/O easy to use too. Because unlike many of the others, your new ZEOS notebook has the same industry standard port connectors you'll find on your larger desktop system. Completely compatible! Serial and Parallel ports; even an external VGA connector. All industry standard and ready to go the minute you receive your system.

It's attention to detail that makes the difference. Tens of thousands of hours of development time have been invested. We've been thinking and re-thinking exactly what you want in a notebook, and now we're building it. Right here at ZEOS, right here in Minnesota. We think you'll agree, it's an incredible product. Plus, your new notebook is backed by the best support in the industry, 24 Hours a Day.

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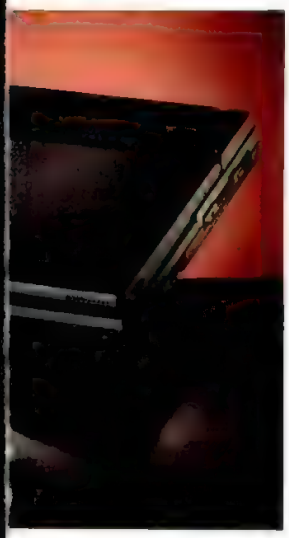

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- Quick charge or trickle charge using included AC power adapter.
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- Total system weight under seven pounds with battery!
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Intel Corporation © 1990 ZEOS International, Ltd. 530 5th Avenue, N.W., St. Paul, MN 55112 USA.

The ZEOS Guide to the Perfect Notebook:

PROCESSOR: PC Magazine recommends a '286 pointing out that "8086- and 8088-based portables have only half to a third of the computing power of a 286." That's why your ZEOS notebook has a '286. More power for you. After all it's just like a 6.5 pound desktop!

DRIVES: *Two drives, built in!* A whisper quiet high speed 20 Megabyte hard disk *plus* a 1.44 Megabyte 3.5 inch floppy. Remember, with a built in floppy drive you don't need to fool around with strange interfaces to load and transfer files.

VIDEO: ZEOS raises the ante to VGA! We're talking about bright and crisp VGA displayed on one of the largest notebook screens in the industry. The display also features advanced fluorescent backlighting, 32 grey scales and 640 x 480 resolution. Plus, it can be adjusted to any position over a 135° angle and features easily adjustable brightness and contrast controls. Easy viewing under virtually any lighting conditions!

GREAT BATTERY FEATURES: Every battery feature you want. You can plug your notebook in and "quick charge" the battery in less than one hour or you can "trickle charge" while in use. Plus your battery easily snaps out allowing the quick installation of an optional replacement battery. It's great to be able to carry a light weight spare for those especially long trips. An optional battery charger stand is available too!

INTELLIGENT POWER MANAGEMENT: Your new ZEOS notebook features an intelligent programmable power management system if you wish to use it. Based on the length of time since your last keystroke, you may reduce CPU speed, display screen backlighting etc. Full power is immediately restored at the stroke of any key. The system even knows *not* to use the power management system when you are operating on AC power!

CHECK IT OUT!

Now, you can take desktop computing power anywhere! Your ZEOS notebook has many features of obvious importance. Also, there are a number of features that are subtle yet critical to your ultimate satisfaction. We'll go over them here one by one. We think you'll agree your new ZEOS Notebook is the one for you!

SYSTEMS STATUS AT A GLANCE: Yes, monitor eight key system components at a glance! We've equipped your new notebook with eight LED indicators which monitor disk access, keyboard functions and power status. There is even an audible alarm which may be programmed to inform you of a low battery condition and to let you know if the cover is closed with the power on. Now that's one smart notebook!

DESKTOP KEYBOARD FEATURES: We're talking 82 full size keys with full 101-key emulation. And the keyboard isn't squeezed either. The distance between the "Q" key and the "[" (left bracket) key measures 7.5 inches, just as PC Magazine suggests. The keys are of standard size, plus touch typists will love our full 3.5mm keystroke. Type for hours and love it!

CONNECTIVITY AND I/O: Keeping in touch is easy when you order our internal 2400 baud MNP Class 5 modem. Simply plug in the phone line and dial away. How about I/O ports? Many notebooks don't have them and if they do they're often non-standard. But your ZEOS notebook has *industry standard I/O*—serial, parallel and VGA. Just like your desktop!

FCC & UL APPROVALS: Your new ZEOS notebook features both FCC Class B and UL approvals. We've also met CSA and VDE requirements too, just for good measure. Quality and reliability. Built right in Minnesota by ZEOS!

WATCH THE DETAILS TOO: Like memory expandability. One Meg comes standard, you can also order a total of 3 or 5MB as a factory option. And lots of other details. Like a recessed power-on reset button, a soft carrying handle, built in speaker and more. You're going to love it! And there's no reason to wait.

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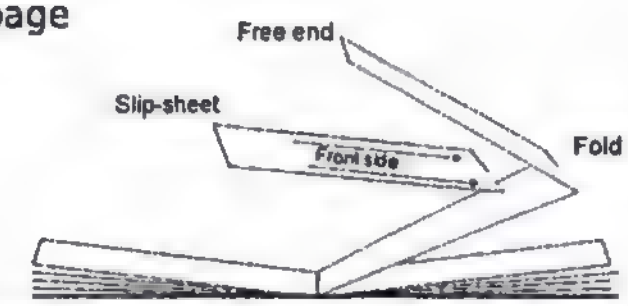
Inverted Foldout slip-sheet

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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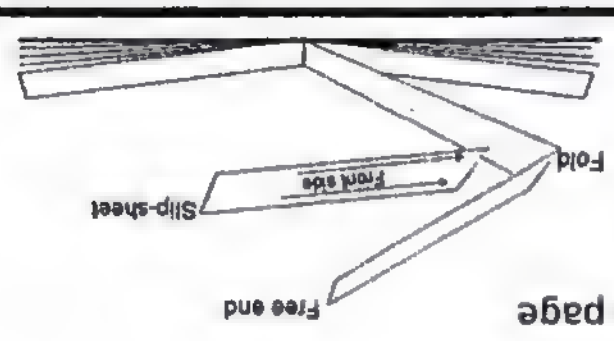
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



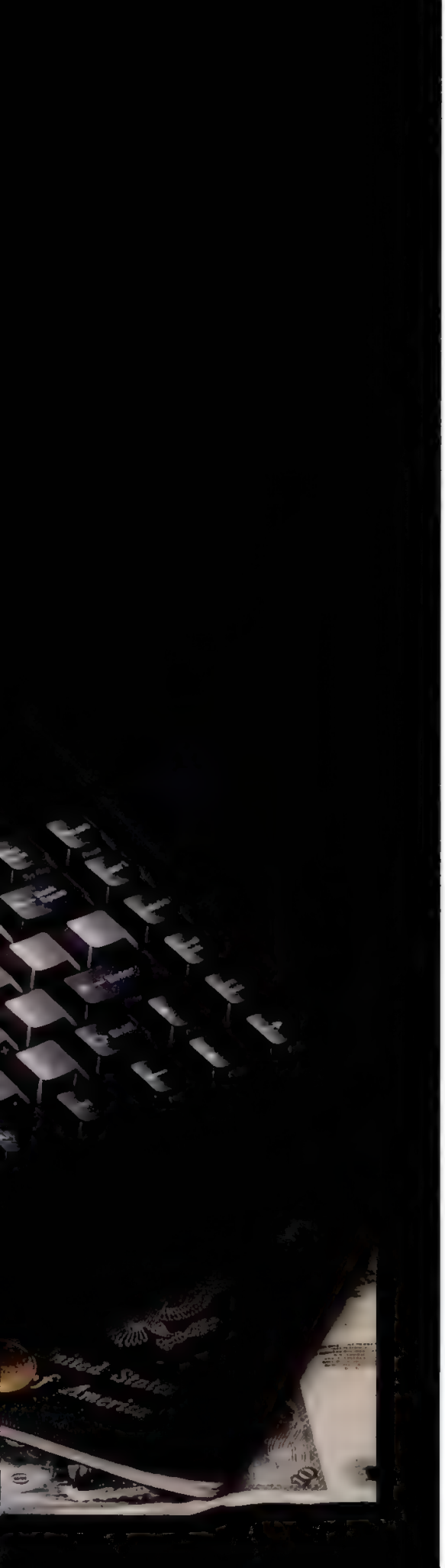
Inverted Back

1. Follow instructions on the other side

GbsSlipBack-001B

Back

1. Follow instructions on the other side



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Complete. $1995. Believe it absolutely! We've designed and manufactured the very best notebook value in the world today. And we've done it for you! Now you can own our complete ZEOS '286 notebook for the *incredible* price of only $1995!

We're talking about '286 power, a high speed hard disk, 1.44 MB floppy drive, VGA and more. All of it *built in*. It's really like owning a 6.5 pound desktop you can take with you anywhere. There is simply nothing else like it at any price. And talk about features.

Light and loaded, your new notebook weighs under seven pounds yet comes packing all the features of a full blown desktop system. Features that no one has yet to combine in a notebook system at a price anywhere close to this. We're talking real desktop features.

INCREDIBLE DESKTOP FEATURES IN A NOTEBOOK.

Such as our crisp 10" VGA display. The ultimate in sparkling clarity. Featuring advanced fluorescent backlighting, you can display vivid VGA graphics under any lighting conditions from virtually any angle. We're talking desktop VGA quality in a notebook! And then the drives.

Two drives are better than one! First, we built in the latest hard drive technology delivering you 20 Megabytes of high speed, high capacity storage. And it's whisper quiet. It will read and write data so fast you may not even know it's there. But we didn't stop at just one drive. We also built in a 1.44 Megabyte, 3.5 inch floppy as well.

While most notebooks don't include a floppy drive at all, you're really going to appreciate your ZEOS notebook's *industry standard* 3.5" floppy. It makes loading software and transferring files a breeze. Simply toss in your 1.44 and it's done. Anyway, can you imagine a desktop system without a floppy? We couldn't either. That's why your ZEOS notebook has one. It's great!

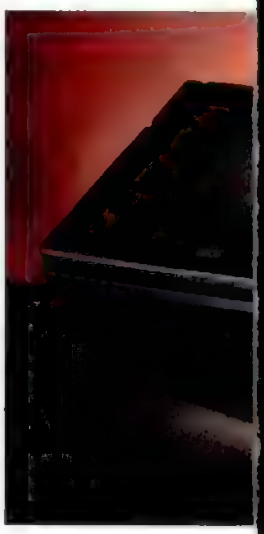
But the features of your incredible new ZEOS Notebook don't just stop there. Detail after detail, we're giving you more than anyone else. Much more, for much less. Take a closer look.

DETAILS MAKE THE DIFFERENCE!

For instance, the battery system of your new notebook is the most advanced on the market. You can quick charge, or trickle charge, any time your system is plugged in. You can also take the battery out and use the optional charging stand if you wish.

Only

Now, you car
computing po
The incredible



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10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but four times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS ... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent." *Personal Computing* said, "ZEOS...is the best value we've come across...its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

And now the Z•CARD! It's your very own ZEOS Credit Card and you can apply today. With the Z•CARD you can charge your ZEOS purchases and pay in easy monthly installments. It's just like a Bank Card. Why not apply for your Z•CARD now!

Reason #10

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When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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Please complete all appropriate sections, *providing at least two years residence and employment history.* If you are self-employed, please be sure to complete "Self Employment Information" section. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call 800-421-8942 For Assistance.** Thank You!

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT.** Do not complete Section C.*

*If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

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☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary $ _____ Bus. Phone (_____) _____

Previous Employer _____ From - To

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income $ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

_____ Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept. Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z•Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

NY—A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH—THE OHIO LAWS AGAINST DISCRIMINATION REQUIRE THAT ALL CREDITORS MAKE CREDIT EQUALLY AVAILABLE TO ALL CREDITWORTHY CUSTOMERS AND THAT CREDIT REPORTING AGENCIES MAINTAIN SEPARATE CREDIT HISTORIES ON EACH INDIVIDUAL UPON REQUEST. THE OHIO CIVIL RIGHTS COMMISSION ADMINISTERS COMPLIANCE WITH THIS LAW.

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence _____ (Mo./Yr.)

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary $ _____

D. SELF-EMPLOYMENT INFORMATION

Business Name _____

Type of Business ☐ Proprietorship ☐ Partnership ☐ Corporation

Business Phone (_____) _____

In Business Since _____

Your Annual Income From Business Gross _____ Net _____

Personal Banker's Name _____

Banker's Telephone Number (_____) _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____

Date _____

Joint Applicant's Signature _____

Date _____

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I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

Buyer's Signature _____ **Date** _____

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33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	ACMA Computers Inc. **ACMA 386/33 Corporate Workstation**	AGI Computer Inc. **AGI 3900B**	American Research Corp. **ARC 386/33 Skyscraper**	Argo Computers Inc. **Argo Tower 386/33**	Automated Computer Technology Corp. **ACT386-33FC**	Bitwise Designs Inc. **Bitwise 333C**	Blue Star Marketing **Blue Star 80386-33**
Price of tested configuration	$3,295	$7,438	$3,575	$3,642	$4,450	$4,275	$3,849
Distribution channel	Direct	Dealers	Dealers, direct	Direct	Direct	Dealers, direct	Dealers, direct
TESTED CONFIGURATION							
Case type	Desktop	Tower	Tower	Tower	Mini-tower	Mini-tower	Desktop
Dimensions (HWD, in inches)	6.5 x 21 x 16.8	26 x 7 x 18.5	23.8 x 6.5 x 19	25.5 x 8 x 18	15.8 x 6.75 x 19.5	18.8 x 6.5 x 15.8	6.5 x 19.3 x 17
Motherboard manufacturer	ACMA	AGI	ARC	Orchid	ACT	Klever Computers	Caching Technologies
386 chip set manufacturer	Discrete logic	Discrete logic	Discrete logic	VLSI	Discrete logic	Chips and Technologies, Discrete logic	Chips and Technologies
System RAM arrangement	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, fast page-mode	Interleaved, page-mode	Page-mode	Interleaved, page-mode, row/column
Wait states	0	0	0	0	0	2	0, 1
Installable RAM options	1MB, 2MB, 3MB, 4MB, 8MB, 12MB, 16MB	2MB, 4MB, 8MB, 12MB, 16MB	1MB, 2MB, 3MB, 4MB, 8MB, 12MB, 16MB	4MB, 8MB, 12MB, 16MB	2MB, 4MB, 8MB, 12MB, 16MB	1MB, 2MB, 4MB, 8MB, 12MB, 16MB	2MB, 4MB, 8MB, 16MB
MOTHERBOARD MEMORY							
Installed RAM	4MB	4MB	4MB	4MB	8MB	4MB	N/A
Maximum installable 32-bit RAM	16MB	8MB	16MB	8MB	8MB	16MB	N/A
RAM packaging (and rated speed)	SIMM (70 ns.)	SIMM (100 ns.)	SIMM (80 ns.)	DIP, SIMM (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	N/A
Chip size installed	1Mb	1Mb	1Mb	1Mb	1Mb	1Mb	N/A
ADD-IN MEMORY BOARD							
Installed RAM	None	None	N/A	None	None	N/A	4MB
Maximum installable 32-bit RAM	8MB	8MB	N/A	12MB	8MB	N/A	16MB
RAM packaging (and rated speed)	SIMM (70 ns.)	SIMM (100 ns.)	N/A	DIP (80 ns.)	SIMM (80 ns.)	N/A	DIP (80 ns.)
Installed chip size	N/A	N/A	N/A	N/A	N/A	N/A	1Mb
Other chips supported	256Kb, 1Mb	1Mb	N/A	1Mb	1Mb	N/A	256Kb, 4x256Kb
PROCESSOR RAM CACHE							
Cache controller	Discrete logic	Discrete logic	Discrete logic	Intel 82385	Intel 82385	Discrete logic	Intel 82385
Installed RAM	64K	64K	64K	32K	64K	64K	64K
RAM packaging (and rated speed)	DIP (25 ns.)	DIP (20 ns.)	DIP (15 ns.)	DIP (20 ns.)	DIP (20 ns.)	DIP (25 ns.)	DIP (25 ns.)
Chip size	64Kb	64Kb	64Kb	32Kb	64Kb	8x8Kb, 4x16Kb	4x16Kb
BIOS							
BIOS version and date	AMI (September 1989)	AMI (February 1990)	AMI (December 1989)	AMI (March 1990)	AMI (April 1990)	AMI (April 1990)	AMI (September 1989)
Setup/Password in ROM	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑
Video shadowing/Can be disabled	❑ / N/A	❑ / N/A	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
System shadowing/Can be disabled	❑ / N/A	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
HARD DISK							
Manufacturer	NEC	Maxtor	Seagate	Conner	Imprimis	Conner	Seagate
Disk capacity	157MB	158MB	137MB	179MB	143MB	105MB	150MB
Interface	ESDI	ESDI	SCSI	IDE	IDE	IDE	ESDI
Controller manufacturer	UltraStor	Everex	Future Domain	DTK	Western Digital	Conner	Data Technology
Integrated floppy/ hard disk controller	■	■	■	❑	❑	■	■
Drive bays	5 half-height	6 half-height	4 half-height, 2 3.5-inch	8 half-height	5 half-height	3 half-height, 4 3.5-inch	5 half-height
Hard disk options	40MB, 65MB, 106MB, 338MB, 676MB (ESDI)	None	40MB, 80MB (IDE); 150MB (SCSI)	661MB (ESDI); 84MB, 212MB (IDE)	89MB, 330MB (IDE)	40MB, 80MB, 100MB, 200MB (IDE)	40MB, 71MB, 110MB (IDE)

☑—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

Brain Computer Corp. **The Brain 386-33**	BSI **BSI 386-33**	CAF Technology Inc. **CAF Master 386C/33T**	Clone Computers **Clone 386-33C**	CompuAdd Corp. **CompuAdd 333T**	Computer Marketplace Inc. **Ultra 386C-33**	Core International **Core 386/33**	CSR Inc. **CSR 386/33**
$3,820	$3,319	$3,179	$3,684	$5,975	$3,995	$10,785	$5,299
Direct	Dealers, direct	Dealers	Direct	Dealers, direct	Direct	Direct	Direct
Desktop	Tower	Tower	Mini-tower	Tower	Tower	Tower	Mini-tower
6.5 x 21 x 16.8	21.5 x 7.3 x 19	24.5 x 7.5 x 17	15.8 x 8.8 x 20	25.8 x 8 x 19	23 x 7.5 x 18	23 x 9 x 24	17.5 x 8.5 x 15
Cache	DTK	CAF Technology	Mek-Fab	CompuAdd, Discrete logic	Orchid Technology	Micronics	Hauppauge
OPTI	VLSI, Discrete logic	Discrete logic	OPTI	Discrete logic	VLSI, Chips and Technologies	Discrete logic	Chips and Technologies
Interleaved, page-mode	Interleaved, page-mode	Page-mode	Interleaved, page-mode	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode
0	0	0	0, 1	5	0	0	0
2MB, 4MB, 6MB, 8MB, 10MB, 12MB, 16MB	1MB, 2MB, 4MB, 5MB, 8MB, 12MB, 16MB	1MB, 2MB, 4MB, 8MB, 16MB	1MB, 2MB, 3MB, 4MB, 5MB, 6MB, 7MB, 8MB, 9MB, 10MB, 12MB, 13MB, 16MB	1MB, 2MB, 3MB, 4MB, 5MB, 6MB, 7MB, 8MB, 9MB, 10MB, 12MB, 13MB, 16MB	1MB, 2MB, 4MB, 8MB, 16MB	4MB, 8MB, 16MB	2MB,4MB
4MB	4MB	4MB	4MB	N/A	4MB	4MB	4MB
16MB	8MB	8MB	8MB	N/A	8MB	16MB	4MB
SIMM (60 ns.)	SIMM (80 ns.)	SIMM (70 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	DIP (80 ns.)	DIP (80 ns.)
256Kb	1Mb	1Mb	1Mb	N/A	1Mb	1Mb	256Kb
N/A	None	None	None	4MB	4MB	8MB	None
N/A	8MB	8MB	8MB	16MB	8MB	8MB	8MB
N/A	SIMM (80 ns.)	SIMM (80 ns.)	DIP (80 ns.)	SIMM (80 ns.)	DIP (80 ns.)	DIP (80 ns.)	DIP (70 ns.)
N/A	N/A	N/A	N/A	1Mb	1Mb	1Mb	N/A
N/A	256Kb, 1Mb	256Kb, 1Mb	256Kb, 1Mb	256Kb	None	None	None
OPTI	Discrete logic	Discrete logic	OPTI	Discrete logic	Intel 82385, Discrete logic	Intel 82385, Discrete logic	Intel 82385, Discrete logic
64K	64K	64K	64K	64K	32K	64K	64K
DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (15 ns.)	DIP (20 ns.)	DIP (35 ns.)	DIP (15 ns.)
64Kb	4x16Kb	8x8Kb	8x8Kb	4x16Kb	4Kb–8Kb	8Kb	8x8Kb
AMI (December 1989)	AMI (September 1989)	AMI (September 1989)	AMI (April 1990)	Phoenix 1.10.02 (June 1990)	AMI (April 1990)	Phoenix 1.10–10B (1990)	Award 3.03SX (June 1989)
■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑
■ / ■	■ / ■	❑ / N/A	■ / ■	■ / ❑	■ / ■	■ / ■	■ / ■
■ / ■	■ / ■	❑ / N/A	■ / ■	■ / ❑	■ / ■	■ / ■	■ / ■
Imprimis	Micropolis	Micropolis	Imprimis	Seagate	Micropolis	Core	CSR
160MB	158MB	150MB	160MB	150MB	158MB	156MB	158MB
IDE	SCSI	ESDI	ESDI	ESDI	ESDI	ESDI	ESDI
Western Digital	Data Technology	Western Digital	Western Digital	CompuAdd	Western Digital	Core	Western Digital
❑	■	■	■	■	■	❑	■
5 half-height	5 half-height	6 half-height	6 half-height	9 half-height	6 half-height	10 half-height	2 half-height
330MB (ESDI); 72MB, 110MB (IDE); 330MB (SCSI)	150MB (ESDI); 40MB, 65MB (RLL)	100MB, 200MB (IDE)	150MB (ESDI); 65MB (RLL); 48MB, 84MB (SCSI)	320MB, 630MB (ESDI); 110MB (IDE)	120MB, 200MB, 300MB, 600MB (ESDI)	310MB (ESDI); 150MB, 310MB (SCSI)	90MB, 150MB, 322MB (ESDI); 1.2GB (SCSI)

CONTINUES

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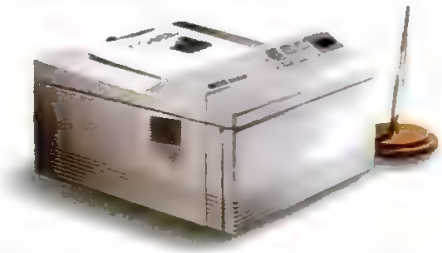

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33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Digital Equipment Corp. **DECstation 333c**	Dynamic Decisions Inc. **Dynex 386-33**	EPS Technologies Inc. **EPS 386-33**	Everest Computer Corp. **Everest Column 333 Professional**	Fortron Source Corp. **Fortron NetSet 333**	GRiD Systems Corp. **GRiD 386ls-33**	Hertz Computer Corp. **Hertz 386/33l**
Price of tested configuration	$6,540	$4,200	$4,020	$3,480	$3,945	$8,449	$7,595
Distribution channel	Dealers, direct	Dealers	Direct	Dealers, direct	Direct	Direct	Direct
TESTED CONFIGURATION							
Case type	Desktop	Desktop	Tower	Tower	Tower	Small-footprint	Tower
Dimensions (HWD, in inches)	6.3 x 17 x 16	5 x 21 x 17	24 x 8 x 21	25 x 7.5 x 16.5	24 x 6.4 x 17.8	6.5 x 17 x 15	24.5 x 6.8 x 26.5
Motherboard manufacturer	Tandy	AMI	EPS	CMP Enterprises	Fortron	Tandy	Intel
386 chip set manufacturer	Chips and Technologies	Describe	Chips and Technologies	Chips and Technologies	Chips and Technologies	Chips and Technologies	Discrete logic
System RAM arrangement	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode
Wait states	0	0	0	0	0	0	0
Installable RAM options	4MB	1MB, 2MB, 4MB, 5MB, 6MB, 8MB	4MB, 8MB, 12MB, 16MB	1MB, 2MB, 4MB, 8MB, 16MB	1MB, 4MB, 8MB, 16MB	2MB, 4MB, 6MB, 8MB, 10MB, 12MB, 16MB	4MB, 8MB
MOTHERBOARD MEMORY							
Installed RAM	1MB	1MB	4MB	4MB	4MB	N/A	4MB
Maximum installable 32-bit RAM	16MB	4MB	8MB	8MB	32MB	N/A	8MB
RAM packaging (and rated speed)	SIMM (80 ns.)	DIP, SIMM (70 ns.)	SIMM (80 ns.)	SIMM (60 ns.)	DIP, SIMM (70 ns.)	N/A	SIMM (80 ns.)
Chip size installed	1Mb	4x256Kb, 1Mb, 4Mb	1Mb	1Mb	1Mb	N/A	1Mb
ADD-IN MEMORY BOARD							
Installed RAM	2MB	None	None	None	None	4MB	None
Maximum installable 32-bit RAM	8MB	8MB	8MB	8MB	32MB	16MB	32MB
RAM packaging (and rated speed)	SIMM (100 ns.)	DIP (70 ns.)	DIP (80 ns.)	DIP (80 ns.)	SIMM (70 ns.)	SIMM (80 ns.)	SIMM (80 ns.)
Installed chip size	1Mb	N/A	N/A	N/A	N/A	N/A	N/A
Other chips supported	1Mb	1Mb	1Mb	1Mb, 4Mb	1Mb	256Kb	1Mb
PROCESSOR RAM CACHE							
Cache controller	Intel 82385, Discrete logic	AMI Describe	Intel 82385, Discrete logic	Discrete logic	Discrete logic	Intel 82385	Discrete logic
Installed RAM	32K	64K	64K	64K	64K	32K	64K
RAM packaging (and rated speed)	DIP (45 ns.)	DIP (15 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (15 ns.)	DIP (20 ns.)	DIP (25 ns.)
Chip size	32Kb	4x16Kb	64Kb	64Kb	64Kb	32Kb	64Kb
BIOS							
BIOS version and date	Phoenix 1.10.00D (February 1990)	AMI (April 1990)	AMI (April 1990)	AMI (September 1989)	AMI (April 1990)	Tandy 01.10.00 (December 1989)	Phoenix 1.10 16.HO (August 1989)
Setup/Password in ROM	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ■	■ / ❑
Video shadowing/Can be disabled	■ / ❑	■ / ■	■ / ■	❑ / N/A	■ / ■	❑ / N/A	■ / ■
System shadowing/Can be disabled	■ / ❑	■ / ■	■ / ■	❑ / N/A	■ / ■	❑ / N/A	■ / ■
HARD DISK							
Manufacturer	Imprimis	Micropolis	Micropolis	Fujitsu	Maxtor	Imprimis	Micropolis
Disk capacity	170MB	160MB	160MB	147MB	151MB	150MB	160MB
Interface	IDE, SCSI	ESDI	ESDI	IDE	ESDI	ESDI	ESDI
Controller manufacturer	Adaptec	Western Digital	Adaptec	Chicony	Western Digital	Adaptec	Ultrastor
Integrated floppy/hard disk controller	❑	■	■	■	■	❑	❑
Drive bays	3 half-height, 1 full-height, 2 3.5-inch	5 half-height	6 half-height	6 half-height	1 full-height, 2 half-height, 2 3.5-inch	2 half-height, 2 3.5-inch	4 half-height, 2 full-height
Hard disk options	105MB (IDE); 80MB, 320MB (SCSI)	150MB, 378MB (ESDI)	118MB, 345MB, 676MB (ESDI)	40MB, 100MB (IDE)	80MB, 300MB, 600MB (ESDI)	40MB, 105MB (IDE); 1.05GB (SCSI)	300MB (ESDI); 80MB (IDE); 160MB, 300MB (SCSI)

★—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

Hyundai Electronics America **Hyundai Super-386T**	Insight Distribution Network Inc. **Insight 386-33**	Master Computer Inc. **Cascade 386/33**	Matrix Digital Products Inc. **Matrix 386/33**	Memorex Telex Corp. **Memorex Telex 7075**	Micro Telesis Inc **MT 386DX**	Mitsuba Corp. **Mitsuba 386-33**	MultiMicro Inc. **MultiMicro MMI-3364T**
$7,254	$3,695	$4,495	$4,880	$11,619	$2,899	$3,895	$4,495
Dealers	Direct	Dealers, direct	Dealers	Direct	Dealers, direct	Dealers	Direct
Small-footprint	Tower	Mini-tower	Tower	Desktop	Mini-tower	Desktop	Tower
6.3 x 16 x 16.5	24 x 7.5 x 19	18.6 x 6.8 x 15.8	23.8 x 7 x 19.1	6.3 x 19.3 x 16.5	15.7 x 8.6 x 19.5	6.5 x 21 x 16.8	24.4 x 7.4 x 16.8
Motherboard	Aramas	Micronics	Micronics	AST	SIC	Micronics	Technology Power
VLSI, Discrete logic	Chips and Technologies	Discrete logic	Micronics	Discrete logic	Discrete logic	Micronics	Discrete logic
Interleaved, page-mode	Interleaved, page-mode	Interleaved	Page-mode	Row/column	Interleaved	Page-mode	Row/column
0	0	0	0	0	0, 1	0	0
1MB, 2MB, 4MB, 8MB	4MB, 8MB, 12MB	1MB, 2MB, 4MB, 8MB, 12MB, 16MB	1MB, 2MB, 4MB, 5MB, 6MB, 8MB, 9MB, 10MB, 12MB, 13MB, 16MB	2MB to 36MB in 1MB increments	1MB, 2MB, 4MB, 8MB, 16MB	1MB, 2MB, 4MB, 5MB, 6MB, 8MB, 10MB, 12MB, 16MB	1MB, 2MB, 4MB, 6MB, 8MB, 10MB, 12MB, 16MB
4MB	4MB	N/A	4MB	4MB	4MB	4MB	4MB
8MB	16MB	N/A	16MB	4MB	16MB	4MB	8MB
SIMM (80 ns.)	DIP, SIMM (80 ns.)	N/A	SIMM (80 ns.)	SIMM (80 ns.)	DIP, SIMM (80 ns.)	SIMM (80 ns.)	SIMM (70 ns.)
1Mb	1Mb	N/A	1Mb	4x256Kb	1Mb	1Mb	1Mb
None	N/A	4MB	None	None	N/A	None	None
8MB	N/A	16MB	16MB	32MB	N/A	16MB	8MB
SIMM (80 ns.)	N/A	DIP (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	SIMM (70 ns.)
N/A	N/A	1Mb	N/A	N/A	N/A	N/A	N/A
256Kb, 1Mb	N/A	256Kb	256Kb, 1Mb	4x256Kb, 1Mb	N/A	256Kb, 1Mb	256Kb, 1Mb
Discrete logic	Intel 82385	Intel 82385	Intel 82385	Intel 82385	Discrete logic	Intel 82385	Discrete logic
64K	64K	64K	64K	32K	64K	64K	64K
DIP (20 ns.)	DIP (20 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (20 ns.)	DIP (25 ns.)	DIP (20 ns.)
64Kb	64Kb	8x8Kb	8x8Kb	8x16Kb	4x16Kb	8x8Kb	4x16Kb
AMI (April 1990)	AMI (December 1989)	Phoenix 1.10 10A (January 1988)	Phoenix 1.10M6 (January 1988)	AST/Award 1.00.02 (April 1990)	AMI (December 1989)	Phoenix 1.10M1 (January 1988)	AMI (December 1989)
■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ■	■ / ❑	■ / ❑	■ / ❑
❑ / N/A	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	❑ / N/A
❑ / N/A	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	❑ / N/A
Conner	Conner	NEC	Seagate	Seagate	NEC	Toshiba	Toshiba
203MB	204MB	158MB	159MB	160MB	143MB	144MB	150MB
IDE	IDE	ESDI	ESDI	ESDI	ESDI	ESDI	SCSI
Silicon Valley Computers	Chicony	Western Digital	Data Technology	Western Digital	Ultrastor	Data Technology	Future Domain
■	■	■	■	■	■	■	■
2 half-height, 2 3.5-inch	2 half-height, 1 full-height, 3 3.5-inch	3 half-height, 5 3.5-inch	1 full-height, 2 half-height, 2 3.5-inch	5 half-height	5 half-height	1 full-height, 3 half-height	6 half-height
40MB, 100MB, 300MB (IDE)	150MB, 340MB (ESDI); 40MB (IDE); 1GB (SCSI)	150MB, 300MB, 600MB (ESDI)	330MB, 660MB (ESDI); 106MB, 200MB (IDE)	70MB, 100MB, 150MB, 338MB (ESDI)	300MB, 600MB, 1.2GB (ESDI)	159MB, 330MB (ESDI); 104MB (IDE)	330MB, 677MB (ESDI)

CONTINUES

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Novacor Inc. **Novas Optimum 386-33**	Peregrine Computers **Peregrine 386/33SF**	Precision Systems Group **Precision 386/33**	Premier Innovations Inc. **Premier 9200**	Quill Corp. **QTech 386-33**	SAI Systems Laboratories Inc. **SAI 386/33**	Swan Technologies **Swan 386/33**
Price of tested configuration	$3,795	$3,999	$4,265	$3,900	$4,040	$3,395	$4,344
Distribution channel	Dealers, direct	Dealers, direct	Dealers	Dealers	Direct	Direct	Direct
TESTED CONFIGURATION							
Case type	Mini-tower	Small-footprint	Desktop	Tower	Desktop	Desktop	Tower
Dimensions (HWD, in inches)	17.5 x 7.3 x 16	6.9 x 14.8 x 16	6.5 x 21 x 16.5	27.5 x 7.5 x 17.5	6.5 x 21.3 x 16.8	6.5 x 21 x 16.3	21 x 7.3 x 20.3
Motherboard manufacturer	Novacor	Atronics International	Hauppauge	Tatung	Everex	80-Data	Micronics
386 chip set manufacturer	Chips and Technologies	SIS	Chips and Technologies	Intel	Chips and Technologies	Discrete logic	Discrete logic
System RAM arrangement	Row/column	Page-mode	Interleaved	Page-mode	Straight linear	Interleaved, page-mode	Interleaved, page-mode
Wait states	0, 1	0, 1	0	0	0	0	0
Installable RAM options	1MB, 2MB, 4MB, 5MB, 6MB, 8MB, 10MB, 12MB, 16MB, 32MB	1MB, 2MB, 4MB, 8MB, 16MB	1MB, 2MB, 4MB	1MB, 4MB	1MB, 2MB, 3MB, 4MB, 8MB, 12MB, 16MB	2MB, 4MB, 6MB, 8MB	2MB, 4MB, 8MB, 10MB, 12MB, 16MB
MOTHERBOARD MEMORY							
Installed RAM	4MB	4MB	4MB	4MB	4MB	4MB	4MB
Maximum installable 32-bit RAM	8MB	8MB	4MB	4MB	16MB	16MB	16MB
RAM packaging (and rated speed)	SIP (80 ns.)	SIMM (70 ns.)	DIP (70 ns.)	SIMM (60 ns.)	SIMM (80 ns.)	SIP (80 ns.)	SIMM (80 ns.)
Chip size installed	9 x 1Mb	1Mb	1Mb	1Mb	256Kb, 1Mb	1Mb	1Mb
ADD-IN MEMORY BOARD							
Installed RAM	None	None	None	None	None	None	None
Maximum installable 32-bit RAM	8MB	8MB	8MB	12MB	8MB	8MB	12MB
RAM packaging (and rated speed)	SIP (80 ns.)	SIMM (70 ns.)	DIP (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	SIP (70 ns.)	SIMM (80 ns.)
Installed chip size	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other chips supported	256Kb, 1Mb	256Kb, 1Mb	256Kb, 1Mb	1Mb	256Kb, 1Mb	256Kb, 1Mb	256Kb, 1Mb
PROCESSOR RAM CACHE							
Cache controller	OPTI	SIS, discrete logic	Intel 82385	Intel 82385	Everex	Intel 82385	Intel 82385
Installed RAM	64K	64K	64K	64K	64K	64K	64K
RAM packaging (and rated speed)	DIP (25 ns.)	DIP (25 ns.)	DIP (15 ns.)	DIP (20 ns.)	DIP (20 ns.)	DIP (20 ns.)	DIP (20 ns.)
Chip size	64Kb	8x8Kb	64Kb	64Kb	64Kb	4x16Kb	4x16Kb
BIOS							
BIOS version and date	AMI (April 1990)	AMI (April 1990)	Award 1.8 (September 1987)	Phoenix 1.10 (June 1989)	AMI (February 1990)	AMI (April 1989)	Phoenix 1.10M6 (April 1990)
Setup/Password in ROM	■ / ■	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑	■ / ❑
Video shadowing/Can be disabled	■ / ■	■ / ■	❑ / N/A	■ / ■	❑ / N/A	■ / ■	❑ / N/A
System shadowing/Can be disabled	■ / ■	■ / ■	❑ / N/A	■ / ■	■ / ■	■ / ■	❑ / N/A
HARD DISK							
Manufacturer	Maxtor	Quantum	Seagate	Imprimis	Maxtor	Conner	Conner
Disk capacity	158MB	161MB	150MB	177MB	158MB	221MB	200MB
Interface	ESDI	IDE	ESDI	IDE	ESDI	IDE	IDE
Controller manufacturer	Data Technology	Informtech	Western Digital	Seagate	Everex	SAI	Conner
Integrated floppy/hard disk controller	■	❑	■	■	■	■	❑
Drive bays	4 half-height, 1 3.5-inch	3 half-height, 1 3.5-inch	3 half-height, 1 full-height	6 half-height or 2 full-height	5 half-height	5 half-height	6 half-height, 1 full-height
Hard disk options	150MB, 300MB (ESDI); 100MB, 200MB (IDE); 150MB, 300MB (SCSI)	300MB, 600MB (ESDI); 200MB (IDE); 300MB, 600MB (SCSI)	80MB, 300MB, 600MB (ESDI)	40MB, 80MB, 111MB (IDE)	80MB, 338MB, 677MB (ESDI)	150MB, 300MB, 600MB (ESDI); 40MB, 100MB, 150MB (IDE); 150MB, 300MB, 600MB (SCSI)	84MB (IDE); 380MB, 660MB (SCSI)

—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

Tandon North America Tandon 386/33	Tatung Co. of America Inc. Tatung TCS-8600T/33	Televideo Systems Inc. Televideo Tele386e	Tenex Computer Express Tenex 386C-33 Power Column	Texas Micro Systems Inc. Texas Micro Systems 3014	Transource Computers Verxion 386/33	Unisys Corp. Unisys Personal Workstation Series 800/33A	Wang Laboratories Inc. Wang PC 350/33C
$4,999	$5,499	$7,609	$3,965	$8,515	$3,699	$9,970	$9,885
Direct	Dealers	Direct	Direct	Dealers	Dealers	Dealers, direct	Dealers, direct
Desktop	Tower	Desktop	Tower	Rack-mount	Tower	Tower	Small-footprint
6.8 x 21 x 15.8	25 x 7.3 x 17.5	6.5 x 16.5 x 16.5	21 x 7.3 x 19.8	7 x 19 x 22.2	25 x 7.5 x 16.5	21.3 x 6.5 x 18.5	6.1 x 16 x 16.5
Tandon, Micronics	Tatung	Televideo	DTK	Texas Micro Systems	Intel	Intel	Micronics
Discrete logic	Discrete logic	Discrete logic	Discrete logic	OPTI, Chips and Technologies	Intel	Intel	Micronics
Page-mode	Page-mode	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Page-mode	Page-mode	Page-mode
0	0	0	0	0	0	0	0
2MB, 4MB, 8MB	1MB, 2MB, 3MB, 4MB, 5MB, 6MB, 7MB, 8MB, 9MB, 10MB, 12MB, 16MB	1MB, 2MB, 4MB, 5MB, 8MB, 16MB	1MB, 2MB, 4MB, 5MB, 8MB, 11MB, 14MB, 16MB	1MB, 2MB, 4MB, 8MB, 16MB	1MB, 2MB, 4MB, 8MB, 16MB, 24MB, 40MB	4MB, 6MB, 8MB, 12MB, 16MB, 20MB, 24MB	1MB, 4MB
N/A	4MB	4MB	4MB	4MB	4MB	4MB	4MB
N/A	16MB	24MB	16MB	16MB	8MB	8MB	4MB
N/A	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	SIMM (60 ns.)	SIMM (80 ns.)	SIMM (100 ns.)	SIMM (80 ns.)
N/A	1Mb	1Mb	1Mb	1Mb	1Mb	1Mb	1Mb
4MB	N/A	4MB	None	N/A	None	None	None
16MB	N/A	16MB	8MB	N/A	32MB	16MB	12MB
DIP (80 ns.)	N/A	DIP (80 ns.)	SIMM (80 ns.)	N/A	SIMM (80 ns.)	SIMM (100 ns.)	SIMM (80 ns.)
1Mb	N/A	256Kb, 1Mb	N/A	N/A	N/A	N/A	N/A
256Kb	N/A	None	256Kb, 1Mb	N/A	1Mb	1Mb	256Kb, 1Mb
Intel 82385	Intel 82385	Intel 82385	Discrete logic	OPTI	Intel	Intel	Intel 82385
64K	64K	64K	64K	64K/128K	64K	64K	64K
DIP (20 ns.)	DIP (20 ns.)	DIP (20 ns.)	DIP (20 ns.)	DIP SIMM (35 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)
4x16Kb	8Kb	4x16Kb	4x16Kb	64Kb	64Kb	64Kb	64Kb
Tandon (July 1990)	Phoenix 1.10.25 (January 1988)	AMI (April 1990)	DTK 4.26 (May 1990)	Phoenix/Texas Micro Systems 1.10 01c (1989)	Phoenix 1.10 19.HO (1989)	Phoenix 1.10 16.HOA (1989)	Wang 1.12, based on Phoenix 1.10M3 (January 1988)
■ / ■	■ / ❑	■ / ❑	■ / ■	■ / ❑	■ / ❑	■ / ❑	❑ / ❑
■ / ■	■ / ■	❑ / N/A	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
■ / ■	■ / ■	❑ / N/A	■ / ■	■ / ❑	■ / ■	■ / ■	■ / ■
Maxtor	Seagate	Maxtor	Micropolis	Control Data	Seagate	Unisys	Conner
200MB	151MB	200MB	150MB	150MB	150MB	140MB	200MB
IDE	ESDI	SCSI	ESDI	ESDI	ESDI	SCSI	IDE
Tandon	Ultrastor	Western Digital	Western Digital	Western Digital	Western Digital	Unisys	Wang
■	■	■	■	■	■	■	❑
8 half-height	6 half-height	2 half-height, 3 3.5-inch	5 half-height	2 full-height, 1 3.5-inch	3 full-height	1 half-height, 2 full-height	3 half-height
300MB (ESDI)	100MB, 300MB, 600MB (ESDI)	40MB, 80MB (IDE)	345MB, 676MB (ESDI); 40MB, 80MB (IDE)	40MB, 104MB (IDE); 70MB (MFM)	300MB, 600MB (ESDI)	40MB, 80MB, 300MB (SCSI)	20MB, 40MB, 100MB (IDE)

CONTINUES

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	ACMA Computers Inc. ACMA 386/33 Corporate Workstation	AGI Computer Inc. AGI 3900B	American Research Corp. ARC 386/33 Skyscraper	Argo Computers Inc. Argo Tower 386/33	Automated Computer Technology Corp. ACT386-33FC	Bitwise Designs Inc. Bitwise 333C	Blue Star Marketing Blue Star 80386-33
FLOPPY DISK DRIVES							
Type	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	TEAC	TEAC	Chinon	TEAC	Toshiba
EXPANSION BUS							
Bus speeds (MHz)	8	8.25, 12.3, 16.5	8	8	8	8	10, 11, 17.5
Expansion slots	1 8-bit, 6 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 6 16-bit	2 8-bit, 5 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 6 16-bit	2 8-bit, 5 16-bit, 1 32-bit
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	5	5	5	6	5	6	3
Ports originate on motherboard	❑	❑	❑	❑	❑	❑	❑
VIDEO							
Display circuitry location	Card	Card	Card	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	Heim Engineering	Everex	Western Digital	Orchid	PowerGraph	Trident	Paradise
Chip set manufacturer	Western Digital, Paradise	Tseng	Western Digital	Tseng	Tseng	Trident	Paradise
KEYBOARD/MOUSE							
Keyboard manufacturer	MaxiSwitch	Key Tronic	ARC	Monterey	BTC	Key Tronic	Nan Tan
Number of keys	101	101	101	101	102	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	66	80	120	100	72	90	78
Mouse port	None	None	None	None	None	None	None
SOFTWARE AVAILABLE							
DOS	4.01	4.01 ($110)	4.01	4.01	4.01	3.3 ($60), 4.01 ($80)	4.01, 3.3 ($80)
OS/2	None	None	1.1 ($199)	None	None	1.2 ($450)	None
Disk caching software	❑	❑	❑	❑	❑	❑	❑
Expanded memory manager	❑	❑	❑	❑	❑	❑	■
Other software included	None	None	*Windows* 3.0	None	*Windows* 3.0	None	None
MISCELLANEOUS							
Coprocessors supported	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167
Physical features:							
Power supply (watts)	200	250	280	230	200	200	200
Dual voltage	■	■	■	■	■	■	■
Number of device connectors	4	6	4	4	5	4	4
Keyboard lock	Front	Front	Front	Front	Front	Front	Front
Case lock	Front	None	None	Front	None	None	Front
Power-on switch	Side	Front	Front	Front	Front	Front	Side
Reset switch	Front	Front	Front	Front	Front	Front	Front
Warranty	1 year parts, 2 years labor	1 year	1 year	4 years on video board, 2 years on motherboard, 1 year other parts and labor	1 year	1 year	4 years on motherboard, and memory, 1 year other parts and labor
Service	Phone service with parts shipping or return to manufacturer	Return to dealer	On-site	Phone service with parts shipping or return to manufacturer	On-site or return to manufacturer	Return to manufacturer or dealer	Phone service with parts shipping, backup on-site service, ship to manufacturer
FCC Class B certification	Pending	■	❑	❑	Pending	❑	Pending

☑—Editor's Choice ■—Yes ❑—No

Brain Computer Corp. **The Brain** 386-33	BSI BSI 386-33	CAF Technology Inc. **CAF Master** 386C 33T	Clone Computers Clone 386-33C	CompuAdd Corp. CompuAdd 333T	Computer Marketplace Inc. Ultra 386C-33	**Core** International Core 386/33	**CSR Inc.** **CSR** 386/33
1.2MB, 1.44MB **Chinon**	1.2MB Panasonic	1.2MB, 1.44MB TEAC	1.2MB, 1.44MB **TEAC**	1.2MB, 1.44MB Mitsumi	1.2MB, 1.44MB **TEAC**, Toshiba	1.2MB, 1.44MB TEAC, Mitsubishi	**1.2MB, 1.44MB** **Toshiba**
8.25, 11, 16.5 2 8-bit, 6 16-bit 6	6, 8 1 8-bit, 6 16-bit, 1 32-bit 5	8 1 8-bit, 5 16-bit, 1 32-bit 4	8.25, 11, 16.5 1 8-bit, 6 16-bit, 1 32-bit 5	8 1 8-bit, 6 16-bit, 1 32-bit 5	8 2 8-bit, 5 16-bit, 1 32-bit 6	8, 11 2 8-bit, 6 16-bit, 2 32-bit 5	8, 33 2 8-bit, 6 16-bit, 1 32-bit 5
❑	❑	❑	❑	■	❑	❑	❑
Card 16-bit Tseng Tseng	Card 16-bit BSI Western Digital	Card 16-bit Hisland Trident	Card 16-bit STB Systems Tseng	Card 16-bit CompuAdd Tseng	Card 16-bit Netis Technology Trident	Card 16-bit Paradise Paradise	Card 16-bit Video Seven Video Seven
Unitek 101 12 72 None	Fujitsu 101 12 87 None	Fujitsu 101 12 93 None	Focus 101 12 84 None	Mitsumi 101 12 101 Serial	Focus 101 14 60 Serial	Focus 101 12 48 None	Focus 101 12 60 None
4.01 ($65) None ❑ ❑ None	4.01, 3.3 ($50) None ❑ ❑ None	4.01 ($50) None ❑ ❑ Silk Spreadsheet	4.01, 3.3 ($79) None ❑ ❑ *Windows* 3.0	4.01 1.21 ($229) ❑ ❑ *Windows* 3.0	3.3, 4.01 1.21 ($355) ❑ ■ *Windows* 3.0	4.01 ($119) None ❑ ■ None	3.3 ($89), 4.01 ($97) None ❑ ❑ None
80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
200 ■ 4 Front None Side Front 1 year	200 ■ 4 Front None Front Front 1 year	200 ■ 4 Front None Front Front 1 year	200 ■ 6 Front None Front Front 1 year	300 ■ 9 Front Back Front None 1 year	300 ■ 5 Front None Front Front 2 years	250 ■ 6 Front Front Front Front 1 year	200 ■ 5 Front Front Front Front 2 years
On-site	Phone service with parts shipping or	Phone service with parts shipping or	Phone service with parts shipping or	On-site	Phone service with parts shipping,	On-site	1 year on-site

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*BYTE Magazine, May 1990. Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future.

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	ACMA Computers Inc. **ACMA 386/33 Corporate Workstation**	AGI Computer Inc. **AGI 3900B**	American Research Corp. **ARC 386/33 Skyscraper**	Argo Computers Inc. **Argo Tower 386/33**	Automated Computer Technology Corp. **ACT386-33FC**	Bitwise Designs Inc. **Bitwise 333C**	Blue Star Marketing **Blue Star 80386-33**
FLOPPY DISK DRIVES							
Type	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	TEAC	TEAC	Chinon	TEAC	Toshiba
EXPANSION BUS							
Bus speeds (MHz)	8	8.25, 12.3, 16.5	8	8	8	8	10, 11, 17.5
Expansion slots	1 8-bit, 6 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 6 16-bit	2 8-bit, 5 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 6 16-bit	2 8-bit, 5 16-bit, 1 32-bit
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	5	5	5	6	5	6	3
Ports originate on motherboard	❑	❑	❑	❑	❑	❑	❑
VIDEO							
Display circuitry location	Card	Card	Card	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	Helm Engineering	Everex	Western Digital	Orchid	PowerGraph	Trident	Paradise
Chip set manufacturer	Western Digital, Paradise	Tseng	Western Digital	Tseng	Tseng	Trident	Paradise
KEYBOARD/MOUSE							
Keyboard manufacturer	MaxiSwitch	Key Tronic	ARC	Monterey	BTC	Key Tronic	Nan Tan
Number of keys	101	101	101	101	102	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	66	80	120	100	72	90	78
Mouse port	None	None	None	None	None	None	None
SOFTWARE AVAILABLE							
DOS	4.01	4.01 ($110)	4.01	4.01	4.01	3.3 ($60), 4.01 ($80)	4.01, 3.3 ($80)
OS/2	None	None	1.1 ($199)	None	None	1.2 ($450)	None
Disk caching software	❑	❑	❑	❑	❑	❑	❑
Expanded memory manager	❑	❑	❑	❑	❑	❑	■
Other software included	None	None	*Windows* 3.0	None	*Windows* 3.0	None	None
MISCELLANEOUS							
Coprocessors supported	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167
Physical features:							
Power supply (watts)	200	250	280	230	200	200	200
Dual voltage	■	■	■	■	■	■	■
Number of device connectors	4	6	4	4	5	4	4
Keyboard lock	Front	Front	Front	Front	Front	Front	Front
Case lock	Front	None	None	Front	None	None	Front
Power-on switch	Side	Front	Front	Front	Front	Front	Side
Reset switch	Front	Front	Front	Front	Front	Front	Front
Warranty	1 year parts, 2 years labor	1 year	1 year	4 years on video board, 2 years on motherboard, 1 year other parts and labor	1 year	1 year	4 years on motherboard, and memory, 1 year other parts and labor
Service	Phone service with parts shipping or return to manufacturer	Return to dealer	On-site	Phone service with parts shipping or return to manufacturer	On-site or return to manufacturer	Return to manufacturer or dealer	Phone service with parts shipping, backup on-site service, ship to manufacturer
FCC Class B certification	Pending	■	❑	❑	Pending	❑	Pending

★—Editor's Choice ■—Yes ❑—No

Brain Computer Corp. **The Brain** 386-33	BSI BSI 386-33	CAF Technology Inc. **CAF Master** 386C 33T	Clone Computers Clone 386-33C	CompuAdd Corp. CompuAdd 333T	Computer Marketplace Inc. Ultra 386C-33	Core International Core 386/33	CSR Inc. CSR 386/33
1.2MB, 1.44MB Chinon	1.2MB Panasonic	1.2MB, 1.44MB TEAC	1.2MB, 1.44MB TEAC	1.2MB, 1.44MB Mitsumi	1.2MB, 1.44MB TEAC, Toshiba	1.2MB, 1.44MB TEAC, Mitsubishi	1.2MB, 1.44MB Toshiba
8.25, 11, 16.5	6, 8	8	8.25, 11, 16.5	8	8	8, 11	8, 33
2 8-bit, 6 16-bit	1 8-bit, 6 16-bit, 1 32-bit	1 8-bit, 5 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 5 16-bit, 1 32-bit	2 8-bit, 6 16-bit, 2 32-bit	2 8-bit, 6 16-bit, 1 32-bit
6	5	4	5	5	6	5	5
❑	❑	❑	❑	■	❑	❑	❑
Card 16-bit Tseng	Card 16-bit BSI	Card 16-bit Hisland	Card 16-bit STB Systems	Card 16-bit CompuAdd	Card 16-bit Netis Technology	Card 16-bit Paradise	Card 16-bit Video Seven
Tseng	Western Digital	Trident	Tseng	Tseng	Trident	Paradise	Video Seven
Unitek	Fujitsu	Fujitsu	Focus	Mitsumi	Focus	Focus	Focus
101	101	101	101	101	101	101	101
12	12	12	12	12	14	12	12
72	87	93	84	101	60	48	60
None	None	None	None	Serial	Serial	None	None
4.01 ($65)	4.01, 3.3 ($50)	4.01 ($50)	4.01, 3.3 ($79)	4.01	3.3, 4.01	4.01 ($119)	3.3 ($89), 4.01 ($97)
None	None	None	None	1.21 ($229)	1.21 ($355)	None	None
❑	❑	❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	■	■	❑
None	None	Silk Spreadsheet	*Windows* 3.0	*Windows* 3.0	*Windows* 3.0	None	None
80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
200	200	200	200	300	300	250	200
■	■	■	■	■	■	■	■
4	4	4	6	9	5	6	5
Front	Front	Front	Front	Front	Front	Front	Front
None	None	None	None	Back	None	Front	Front
Side	Front	Front	Front	Front	Front	Front	Front
Front	Front	Front	Front	None	Front	Front	Front
1 year	1 year	1 year	1 year	1 year	2 years	1 year	2 years
On-site	Phone service with parts shipping or return to manufacturer or dealer	Phone service with parts shipping or return to manufacturer or dealer	Phone service with parts shipping or return to manufacturer	On-site	Phone service with parts shipping, on-site backup	On-site	1 year on-site
Pending	■	❑	■	■	❑	❑	■

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Products listed in alphabetical order by company name

	Digital Equipment Corp. **DECstation 333c**	Dynamic Decisions Inc. **Dynex 386-33**	EPS Technologies Inc. **EPS 386-33**	Everest Computer Corp. **Everest Column 333 Professional**	Fortron Source Corp. **Fortron NetSet 333**	GRiD Systems Corp. **GRiD 386Is-33**	Hertz Computer Corp. **Hertz 386/33I**
FLOPPY DISK DRIVES							
Type	1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
Manufacturer	Sony	TEAC	TEAC	TEAC	TEAC	Sony	TEAC
EXPANSION BUS							
Bus speeds (MHz)	8	8	8, 11, 16.5	8.25	8	8	8
Expansion slots	6 16-bit, 2 32-bit	3 8-bit, 5 16-bit, 1 32-bit	3 8-bit, 5 16-bit	1 8-bit, 7 16-bit	1 8-bit, 6 16-bit, 1 32-bit	4 16-bit, 1 32-bit	1 8-bit, 7 16-bit, 2 32-bit
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	3	4	5	6	5	4	8
Ports originate on motherboard	❑	❑	❑	❑	❑	■	■
VIDEO							
Display circuitry location	Card	Card	Card	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	Tandy	ATI	Orchid	Everest	Fortron	Tandy	Trident
Chip set manufacturer	Paradise	ATI	Tseng	Western Digital	Western Digital	Paradise	Trident
KEYBOARD MOUSE							
Keyboard manufacturer	Tandy	Dynex	Fujitsu	Nan Tan	NMB	GRiD Systems	Hertz
Number of keys	101	101	101	102	101	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	60	60	60	120	84	120	84
Mouse port	PS/2	Serial	None	None	Serial	PS/2	PS/2
SOFTWARE AVAILABLE							
DOS	4.01	3.3	3.3, 4.01 ($65)	4.01 ($95)	4.01	4.01 ($150)	3.3, 4.01
OS/2	1.1 ($340)	None	None	None	None	None	1.2 ($357)
Disk caching software	■	❑	❑	❑	■	■	❑
Expanded memory manager	■	❑	■	❑	■	❑	❑
Other software included	None	*Windows* 3.0	None	None	*Windows* 3.0	None	None
MISCELLANEOUS							
Coprocessors supported	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167
Physical features:							
Power supply (watts)	200	200	220	235	220	200	302
Dual voltage	■	■	■	■	■	■	❑
Number of device connectors	3	6	5	4	4	4	4
Keyboard lock	None	Front	Front	Front	Front	None	Front
Case lock	None	None	Front	None	None	Front	None
Power-on switch	Front	Side	Front	Front	Front	Front	Front
Reset switch	Front	Front	Front	Front	Front	Front	Front
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Service	Return to manufacturer	On-site	On-site	Return to dealer	On-site	Depot service, return to manufacturer	On-site
FCC Class B certification	■	■	■	■	Pending	■	■

⊡ —Editor's Choice ■—Yes ❑—No

Hyundai Electronics America **Hyundai Super-386T**	Insight Distribution Network Inc. **Insight 386-33**	Master Computer Inc. **Cascade 386/33**	Matrix Digital Products Inc. **Matrix 386/33**	Memorex Telex Corp. **Memorex Telex 7075**	Micro Telesis Inc. **MT 386DX**	Mitsuba Corp. **Mitsuba 386-33**	MultiMicro Inc. **MultiMicro MMI-3364T**
1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB
TEAC	TEAC, Toshiba	Chinon	Epson	TEAC	Mitsumi, Panasonic	Epson	TEAC
8.25	8, 10	8.25, 11	8.25, 11, 16.5	8	10	8.25, 11, 16.5	8
1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 6 16-bit	2 8-bit, 5 16-bit, 1 32-bit	1 16-bit, 1 32-bit	1 8-bit, 3 16-bit, 3 32-bit	2 8-bit, 6 16-bit	7 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit
6	6	3	4	5	5	5	4
■	■	❑	❑	■	❑	❑	❑
Card	Card	Card	Card	Card	Card	Card	Card
16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
ATI	ATI	ATI	Paradise	Headland Technologies	Paradise	Paradise	Orchid
ATI	ATI	ATI	Paradise	Video Seven	Paradise	Paradise	Tseng
Oki Japan	Chicony	Key Tronic	Hi-Tek	NMB	Key Tronic	Honeywell	Key Tronic
101	101	101	101	101	101	101	101
12	12	12	12	12	12	12	12
84	96	72	78	72	72	124	72
Serial	None	Bus	None	None	None	None	None
4.01	3.3, 4.01	3.3, 4.01	3.3, 4.01	3.3, 4.01 ($130)	3.3, 4.01	3.3 ($75), 4.01 ($85)	3.3 ($79), 4.01 ($89)
None	None	None	None	1.1 ($325)	None	None	None
❑	❑	❑	❑	❑	❑	❑	❑
❑	❑	■	■	■	❑	■	❑
None	None	None	*QAPlus, Disk Manager* 4.0	*QEMM-386* 5.0	*Windows* 3.0 ($90)	Unix, SCO Xenix	None
80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
202	250	200	250	220	200	200	250
■	■	■	■	■	■	■	■
4	5	4	5	4	5	5	4
Front	Front	Front	Front	None	Front	Front	Front
None	None	None	None	Back	None	None	None
Front	Front	Front	Front	Side	Front	Side	Front
Front	Front	Front	Front	Front	Front	Front	Front
18 months	1 year	1 year	1 year	90 days	13 months	1 year	1 year
Return to dealer	On-site	Return to dealer	Return to dealer	On-site or carry-in	Phone service with parts shipping	Return to dealer	On-site, phone service with parts shipping
■	■	❑	❑	■	Pending	■	❑

CONTINUES

33-MHz 386-BASED PCs: SUMMARY OF FEATURES

Products listed in alphabetical order by company name

	Novacor Inc. Novas Optimum 386-33	Peregrine Computers Peregrine 386 33SF	Precision Systems Group Precision 386 33	Premier Innovations Inc. Premier 9200	Quill Corp QTech 386-33	SAI Systems Laboratories Inc. SAI 386 33	Swan Technologies Swan 386 33
FLOPPY DISK DRIVES							
Type	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	TEAC	Panasonic, Toshiba	TEAC	TEAC	Sony, TEAC
EXPANSION BUS							
Bus speeds (MHz)	8, 10, 12	8.25, 11, 16.5	8.25	8	8, 11, 16	8, 11	8
Expansion slots	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 5 16-bit, 1 32-bit	1 8-bit, 6 16-bit, 1 32-bit	3 8-bit, 5 16-bit	1 8-bit, 6 16-bit, 1 32-bit	2 8-bit, 5 16-bit, 1 32-bit	7 16-bit, 1 32-bit
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	5	5	5	5	5	5	6
Ports originate on motherboard	❑	❑	❑	❑	❑	❑	❑
VIDEO							
Display circuitry location	Card	Card	Card	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	Novas	Diamond	Paradise	Premier	Everex	Paradise	Tseng Labs
Chip set manufacturer	Chips and Technologies	Tseng	Paradise	Trident	Trident	Paradise	Tseng
KEYBOARD MOUSE							
Keyboard manufacturer	MaxiSwitch	NMB	Hi-Tek	Forward	Key Tronic	Focus	NMB
Number of keys	101	101	101	101	101	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	72	72	144	70	72	60	84
Mouse port	None	Serial	None	None	None	None	None
SOFTWARE AVAILABLE							
DOS	3.3, 4.01 ($75)	4.01	3.3, 4.01	4.01	3.3, 4.01	4.01	4.01
OS/2	None	None	None	None	None	None	None
Disk caching software	❑	■	■	❑	❑	❑	❑
Expanded memory manager	❑	■	■	❑	■	❑	❑
Other software included	None	*Windows* 3.0	None	None	None	None	*QAPlus*
MISCELLANEOUS							
Coprocessors supported	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
Physical features:							
Power supply (watts)	200	200	200	230	200	200	230
Dual voltage	■	■	■	■	■	■	■
Number of device connectors	8	4	4	5	4	4	5
Keyboard lock	Front	Front	Front	Front	Front	Front	Front
Case lock	None	None	None	Back	None	None	Front
Power-on switch	Front	Front	Side	Front	Side	Front	Front
Reset switch	Front	Front	Front	Front	Front	Front	Front
Warranty	1 year	1 year	2 years parts	1 year	1 year	1 year	1 year
Service	Return to manufacturer	Return to dealer	Return to manufacturer	On-site	On-site	3 years phone service	Phone service with on-site backup
FCC Class B certification	Pending	Pending	❑	■	Pending	❑	❑

—Editor's Choice ■—Yes ❑—No

Tandon North America **Tandon 386/33**	Tatung Co. of America Inc. **Tatung TCS-8600T/33**	Televideo Systems Inc. **Televideo Tele386e**	Tenex Computer Express **Tenex 386C-33 Power Column**	Texas Micro Systems Inc. **Texas Micro Systems 3014**	Transource Computers **Verxion 386/33**	Unisys Corp. **Unisys Personal Workstation Series 800/33A**	Wang Laboratories Inc. **Wang PC 350/33C**
1.2MB, 1.44MB Tandon	1.2MB YE-Data	1.2MB Epson	1.2MB, 1.44MB Mitsumi	1.2MB, 1.44MB Mitsubishi, Sony	1.2MB, 1.44MB TEAC	1.44MB TEAC	1.2MB, 1.44MB Mitsubishi, Sony
8, 11 2 8-bit, 5 16-bit, 1 32-bit 5 ❑	8, 12 3 8-bit, 5 16-bit 5 ❑	8 1 8-bit, 7 16-bit 6 ❑	8 2 8-bit, 6 16-bit 5 ❑	8.25, 11 2 8-bit, 12 16-bit 11 ❑	8 1 8-bit, 5 16-bit, 2 32-bit 6 ■	8 1 8-bit, 5 16-bit, 2 32-bit 6 ■	8 5 16-bit, 1 dual-purpose 4 ❑
Card 16-bit Tandon Zymos	Card 16-bit Tatung Paradise	Card 16-bit Western Digital Paradise	Card 16-bit Trident Trident	Card 16-bit Texas Micro Systems Tseng	Card 16-bit MIT Paradise	Card 16-bit Western Digital Western Digital	Card 16-bit Video Seven Video Seven
MaxiSwitch 101 12 84 Serial	Forward 101 12 84 None	Chicony 101 12 84 None	Chicony 101 12 84 None	EECO 101 12 79 None	Monterey 101 12 76 PS/2	Unisys 101 12 108 None	Honeywell 101 12 108 Serial
3.3, 4.01 None ❑ ❑ *Windows* 3.0	4.01 None ❑ ❑ None	4.01 None ❑ ❑ None	4.01 None ❑ ❑ None	3.3 ($95), 4.10 ($125) None ❑ ❑ None	3.0, 4.01 ($60) None ❑ ❑ None	4.01 with *Windows* 3.0 ($195) 1.2 ($340) ■ ❑ None	3.3, 4.01 1.2 ($340) ❑ ■ *Wang Diagnostics*
80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
190 ■ 4 None Back Back Front 1 year Phone service ■	230 ■ 4 Front Back Front Front 1 year 4 months on-site, then return to dealer ■	200 ■ 4 None Side Front Front 1 year On-site Pending	200 ■ 5 Front None Front Front 1 year Phone service, on-site available ■	220 ❑ 6 None Front Front Front 1 year Return to manufacturer, on-site available ❑	220 ■ 5 Front None Front Front 1 year Return to manufacturer or dealer, on-site available ❑	304 ■ 5 Front Front Top Front 1 year Return to manufacturer or dealer, on-site available ■	145 ■ 3 Front Front Front None 1 year Return to dealer or service center ❑

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appropriate choice for a drive-crazy single user or as a file server.

Argo has relabeled the superb Orchid system, selling it for $3,534 in the standard configuration, including 4MB RAM, a 32K processor RAM cache, a Connor IDE hard disk formatted to 179MB (it can be formatted to 212MB maximum), a 1.2MB TEAC floppy disk drive, and an Orchid 1,024-by-768 display adapter using the powerful Tseng ET4000 chip set. A 14-inch Sony MultiScan Super VGA color monitor, capable of 1,024-by-768 interlaced resolution, is also part of the deal. It's all topped off with a Monterey 101-key keyboard, one parallel and two serial ports, and DOS 4.01 or 3.3. Our test machine also included a 1.4MB floppy disk drive and a Logitech serial mouse,

Argo Tower 386/33, $3,642

raising the final price to $3,652.

The 386/33 houses an Orchid motherboard using a VLSI brand 386 chip set and AMI ROM BIOS. The unit runs at either 11.2 MHz or 33.3 MHz, with the bus speed fixed at 8 MHz. The system supports both video and system ROM BIOS shadowing, either of which can be selected via the CMOS setup program. The motherboard has a math coprocessor socket that can handle either an Intel 80387 33-MHz or Weitek 3167 number cruncher.

The nonexpandable 32K processor RAM cache uses 20-nanosecond SRAM chips and utilizes the Intel 82385 cache controller for a two-way associative caching scheme. A maximum of 8MB of fast page interleaved system memory can be installed on the motherboard using 80-ns. 1MB SIMM memory modules; you can also use 256K modules on the motherboard. A $199 proprietary memory expansion board takes up to 12MB of RAM with 1MB SIMM modules, although the system can address just up to 16MB of RAM. Argo Computers' price for memory upgrades at the time of this review was $73 per megabyte, the lowest quoted retail price we've seen to date.

NO DEARTH OF DRIVES

The Argo's case measures 25.5 by 8 by 18 inches. All buttons and switches are on the front, including the power switch, turbo, and reset buttons, and a combination keyboard and case lock. The drive chassis has a stack of eight half-height 5.25-inch drive bays that can also be used for four full-height drives, or combinations of the two types. The top four bays can use drives with removable media.

The 230-watt Procase power supply has only four device power leads, too few for the system's potentially very full house of drives. Additionally, there's only one fan in the system, so if you load this box with RAM and drives, it will probably be a good idea to add an intake fan on the bottom inside front to aid in cooling.

The system has a standard complement of interface card expansion slots: two 8-bit, five 16-bit, and a 32-bit for the optional proprietary memory expansion card. The 32-bit slot will also accept a standard 8-bit card.

Argo's 386/33 is certainly no performance slouch. It scored right in the middle of the tested group on the processor, memory, and small-record DOS File Access tests. The large-record DOS File Access test result was a bit below average, but on the BIOS Disk Seek test the Conner drive outperformed its 16-millisecond rating by scoring 15 ms. The video benchmark test scores were all in the top quarter of the tested group.

Located in Reno, Nevada, Argo Computers currently sells through two of its own retail stores and via mail order, with 90 percent of its sales distributed through the latter channel. Orchid backs this system with a warranty that includes parts and labor for four years on the video board, two years on the motherboard, and one year on everything else. There is no provision for on-site service, but Argo will ship replacement parts or pay shipping both ways if a unit fails in the first 80 days after purchase. For the balance of the warranty period, the vendor pays shipping one way only.

The Argo 386/33 is a well-performing machine at a competitive price. It offers ample drive space for use as a file server, though a larger power supply with more device leads and a second fan are in order if you're going to stuff one of these computers to maximum capacity.

Automated Computer Technology Corp.

ACT386-33FC

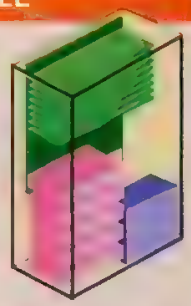
by Bruce Brown

Automated Computer Technology's 33-MHz mini-tower machine is a class act all the way around. The ACT386-33FC standard configuration's $4,450 price tag is slightly higher than other 33-MHz machines sold via mail order, but you may well decide the extra money is worth it for the overall quality.

The standard configuration comes with 4MB RAM, a 64K processor RAM cache, a 167MB Seagate/CDC/Imprimis 15-millisecond IDE hard disk, and a Chinon 1.2MB floppy disk drive. The video system includes a PowerGraph 1,024-by-768 interlaced Super VGA display adapter with the impressive Tseng ET4000 video chip set, and a CTX CSV-3450 Super VGA color monitor. Other standard configuration features include a 102-key BTC keyboard, two serial ports, one parallel port, DOS 4.01, *Windows* 3.0, and a Microsoft serial mouse.

Our test machine arrived equipped with 8MB RAM, an 80387 33-MHz coprocessor, and both 1.2MB and 1.44MB Chinon

FACT FILE



ACT386-33FC
Automated Computer Technology Corp., 2307 Spencer St., Pasadena, TX 77504; (800) 521-9237.
List Price: With 4MB RAM, 45MB hard disk, 1.2MB or 1.44MB floppy disk drive, monographics video adapter and monitor, one parallel and two serial ports, DOS 4.01, *Windows* 3.0, and Microsoft Mouse, $3,395; with 167MB hard disk, Super VGA video adapter, Super VGA color display, $4,450; with 8MB RAM, both floppy disk drives, 80387-33MHz math coprocessor, $5,484.
In Short: The mini-tower ACT386-33FC is a well-made machine with good components and a terrific case, better than average speed, a reasonable price, and on-site service. It's a good choice if you need a high-performance single-use workstation.

CIRCLE 545 ON READER SERVICE CARD

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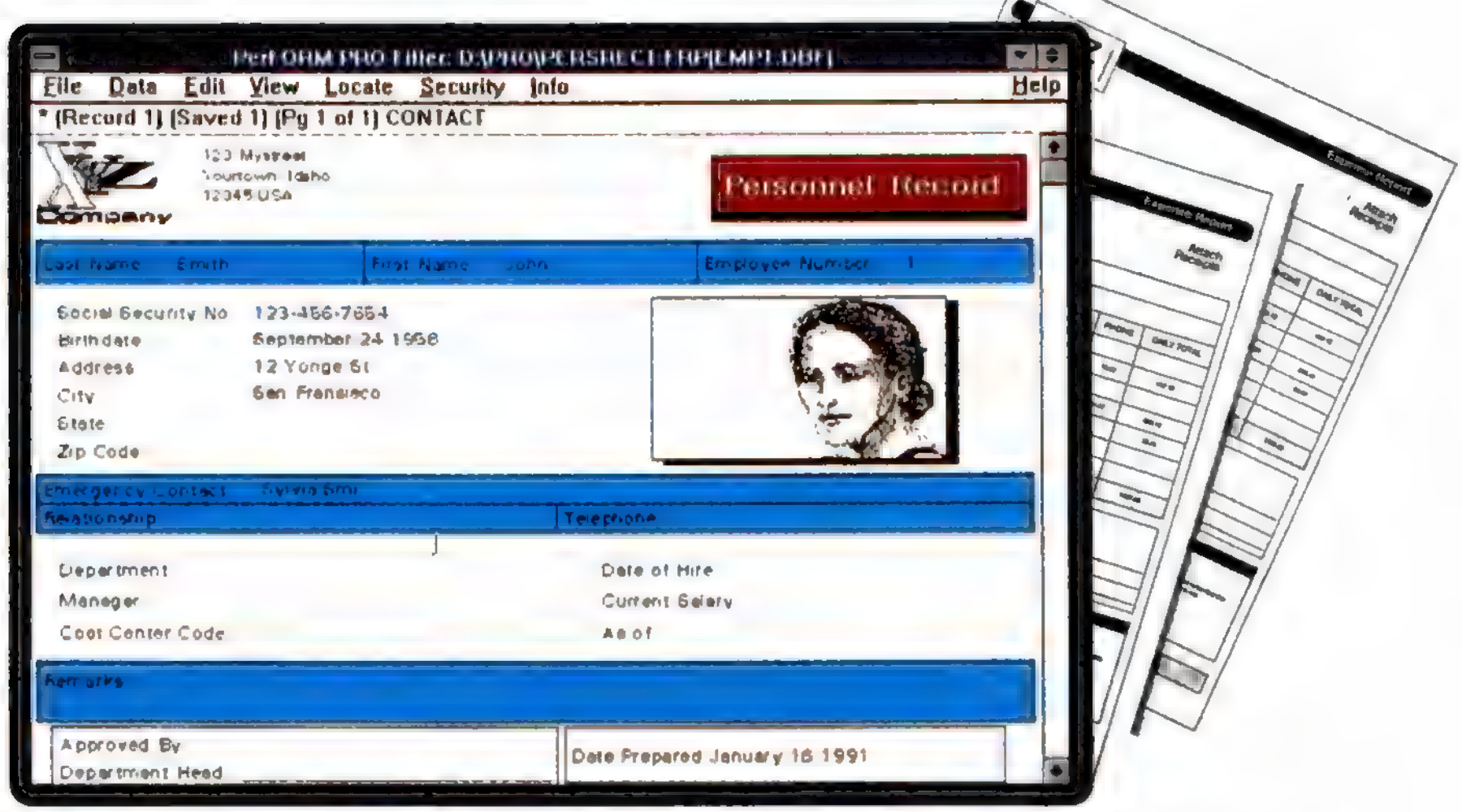

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Data Based Advisor, October 1990

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ACT386-33FC, $4,450

floppy disk drives, at a list price of $5,484. However, the ACT386-33FC achieved its noteworthy benchmark test scores with only 4MB RAM installed (a math coprocessor chip will not affect benchmark test results). The benchmark test scores generally testify to the ACT386-33FC's intelligent design and combination of components. The processor scores were way above average, the memory time was right in the middle of the pack, and the small-record DOS File Access time ranked in the top quarter. However, that was balanced by the large-record DOS File Access time, which fell among the bottom quarter of units tested. While the Video BIOS Routine test scores hovered in the low average range, the video Direct to Screen test score was one of the fastest.

The motherboard is ACT's own, using discrete circuitry instead of a separate 386 chip set, the Intel 82385 RAM processor RAM cache controller, and the AMI ROM BIOS. The processor RAM cache uses 20-nanosecond SRAM chips, and can be expanded to 256K. If you wish to install a Weitek math coprocessor you can, but not simultaneously with an 80387 chip. The system allows optional selection of both video and ROM BIOS shadowing.

The ACT386-33FC accommodates either 256K or 1MB 80-ns. SIMM memory modules in an interleaved page-mode memory scheme. With 1MB modules you can have a maximum of 8MB on the motherboard; expanding to the system's 16MB maximum requires a proprietary memory expansion card.

The ACT's case, measuring 15.8 by 6.8 by 19.5 inches, is impressive. The idea of a mini-tower design is to have a case that sits on a desktop without taking up too much space, and that lets you easily insert and remove floppy disks, tapes, CDs, or other removable media. A full-height door covers the fronts of all the ACT's drive bays and the reset and turbo buttons and keyboard lock; a window lets you see the two-digit LED processor speed display. With the door closed, the only accessible control is the front, top-mounted, red power switch.

CONCERN FOR QUALITY

Inside, the FCC Class A case's construction shines—as does the quality drive chassis and other support bracing. All of the internal support structures are shiny and well-finished, a touch that doesn't directly matter to performance but does indicate a concern for quality.

There is room in the ACT386-33FC for five half-height 5.25-inch drives, stacked one on top of another in the front of the machine. All five can use removable media, an unlikely necessity but an arrangement that allows flexibility in where you place which drives. A 200-watt Enhance power supply has five device connectors, so if you decide to load the case with drives you needn't search for a power splitter.

> The ACT386-33FC is a well-made machine with easy drive access, good performance, and impressive attention to construction detail.

The ACT offers the usual complement of expansion card slots with one 8-bit slot and six 16-bit slots; an eighth slot can be used either for the 32-bit proprietary memory card or as a second 8-bit slot.

Automated Computer Technology sells computers via mail order and through a direct sales force. The company's background is in mainframe software development and many of those customers make up its computer business. ACT computers come with a standard one-year parts-and-labor warranty and an on-site service contract with TRW. The service contract targets a 24- to 48-hour response time, if the problem cannot be determined and fixed over the telephone.

The ACT386-33FC is a well-made machine with easy drive access, good performance, and impressive attention to construction detail. This computer is easy to recommend.

Bitwise Designs Inc.

Bitwise 333C

by M. David Stone

Just under 19 inches tall, the Bitwise 333C, from Bitwise Designs Inc., qualifies as a large mini-tower, though Bitwise prefers to call it midsize. By either designation, it offers plenty of room for expansion and an innovative drive bay arrangement for maximum flexibility. To cap it off, it's a better than average performer at a midrange price.

The 333C's *PC Magazine* standard configuration lists for $4,275 and comes with 4MB RAM, a 64K RAM cache, a TEAC 1.2MB floppy disk drive, an 18-millisecond 153MB hard disk, a CTX VGA monitor with 720-by-480 maximum resolution, a 101-key Key Tronic keyboard, one parallel, one game, and two serial ports, and DOS 4.01. However, our review unit arrived with a Conner 100MB 3.5-inch hard disk and cost $3,975. For $2,700 Bitwise offers a base configuration of 1MB RAM, a 20MB hard disk, a Hercules-compatible card, and monitor. All prices include a one-year guarantee.

One of the 333C's more interesting features is its drive bay arrangement, which can hold either five half-height 5.25-inch drives or three half-height 5.25-inch and four half-height 3.5-inch drives. Three 5.25-inch bays and two 3.5-inch bays are accessible with the case on. In addition to its flexibility, this design provides more room for expansion than you would ex-

Bitwise 333C, $4,275

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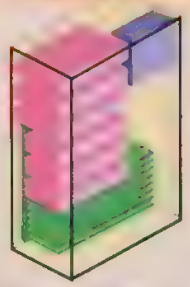


Bitwise 333C
Bitwise Designs Inc., 701 River St., Troy, NY 12182; (800) 367-5906, (518) 274-0755.
List Price: With 1MB RAM, 64K cache RAM, 20MB hard disk, 1.2MB floppy disk drive, Hercules-compatible monochrome display, one parallel, one game, and two serial ports, $2,700; with 4MB RAM, 153MB hard disk, Super VGA display, DOS 4.01, $4,275.
In Short: Designed as a large mini-tower—or midsize tower, as Bitwise prefers to call it—the Bitwise 333C offers an innovative bay arrangement, plenty of room for expansion, and better-than-average performance at a midrange price.

CIRCLE **546** ON READER SERVICE CARD

pect in an 18.8- by 6.5- by 15.8-inch system unit. But given the capacities of currently available 3.5-inch hard disks, even the seven-bay arrangement may prove barely adequate for a network or power user's system.

Bitwise covered the two accessible 3.5-inch bays with dummy floppy disk bezels, so that if you look at the review system from a distance, it seems to have two 3.5-inch disk drives. In fact, our review system came with just the floppy disk drive and the 100MB 3.5-inch hard disk, leaving two 5.25-inch bays and three 3.5-inch bays still available. The turbo switch on the front panel is also strictly decorative, since the system operates only at 33 MHz.

Inside the box, the Klever Computers motherboard houses a standard set of components, including a 33-MHz 80386 processor, AMI BIOS, a coprocessor socket for an 80387, a combination of discrete logic plus one chip from the Chips and Technologies chip set, and discrete logic for controlling the system cache. Bitwise sells the unit with either 64K or 128K cache. However, our tested machine's 64K was more than adequate, considering that the 333C's performance was among the best on PC Labs' processor and memory benchmark tests.

A WISE UPGRADE CHOICE

The 333C takes only SIMM memory, in sixteen SIMM sockets on the motherboard. This notable extra lets you upgrade to the maximum 16MB without using a system slot. The review unit had four 1MB SIMM modules installed. Also on the motherboard are six 16-bit and two 8-bit slots. On our review system, two were filled—one with a Trident 8916-2/4 Super VGA card (with both interlaced and noninterlaced 8514/A modes), and one with a DTK PTI-217 disk controller and I/O card. The DTK card had both a serial port and parallel port on the card itself, plus a second serial port and game port connected by cable. The additional connectors were mounted in two of the five connector cutouts on the back panel, saving yet another slot.

Scores on disk tests were well below average, but that's largely a function of the 25-millisecond drive in our review unit. Results would presumably be better with a faster drive. Performance on the video tests was slightly better than average.

Certainly the Bitwise 333C has more going for it than against it. The number of bays may be limiting for some purposes, but the number of available slots offers more room for expansion than many systems. And even with the handicap of a relatively slow disk, the overall performance is still better than average. For most purposes, this 33-MHz 386 is a good, if not outstanding, choice.

Blue Star Marketing

Blue Star 80386-33

by M. David Stone

Blue Star Marketing's desktop 80386-33 is strong on both service and support. And if its performance is on the low side of average, well then, so is the price.

Included in the $3,749 standard configuration are 4MB RAM, a 64K cache, a 150MB Seagate hard disk, a 1.2MB or 1.44MB floppy disk drive, an NEC 3D monitor, a Paradise VGA 1,024 card (with up to 1,024-by-768 resolution), a Nan Tan 101-key keyboard, one parallel, one game, and two serial ports, and DOS 4.01. Our review unit came with two floppy disk drives, boosting the system price to a still low $3,849. For those who like to design their own systems, Blue Star offers a $1,839 basic configuration with 1MB RAM, no cache, one floppy disk drive, one parallel, one game, two serial ports, and a keyboard.

The Caching Technologies' motherboard leans heavily on VLSI technology with its lower power requirements. T board is dominated by relatively few large chips, including the 80386, the Chips and Technologies chip set, the Intel 82385 cache controller, and a coprocessor socket for an 80387 or Weitek 3167. Also on the board is an AMI BIOS and 64K of 25-nanosecond cache. Although the system can take either 32K or 64K of cache, Blue Star Marketing sells it only with 64K.

FACT FILE

Blue Star 80386-33
Blue Star Marketing, 2312 Central Ave. NE, Minneapo 8884, (612) 788-140
List Price: With 1MB floppy disk drive, one p two serial ports, $1,839; cache RAM, 150MB hard display system, DOS 4.01, $ and 1.44MB floppy disk drives
In Short: Blue Star Marketing's support, backup on-site service, warranty on the motherboard and make a good package. However, yo easily find the same overall performa PC with a lower list price.

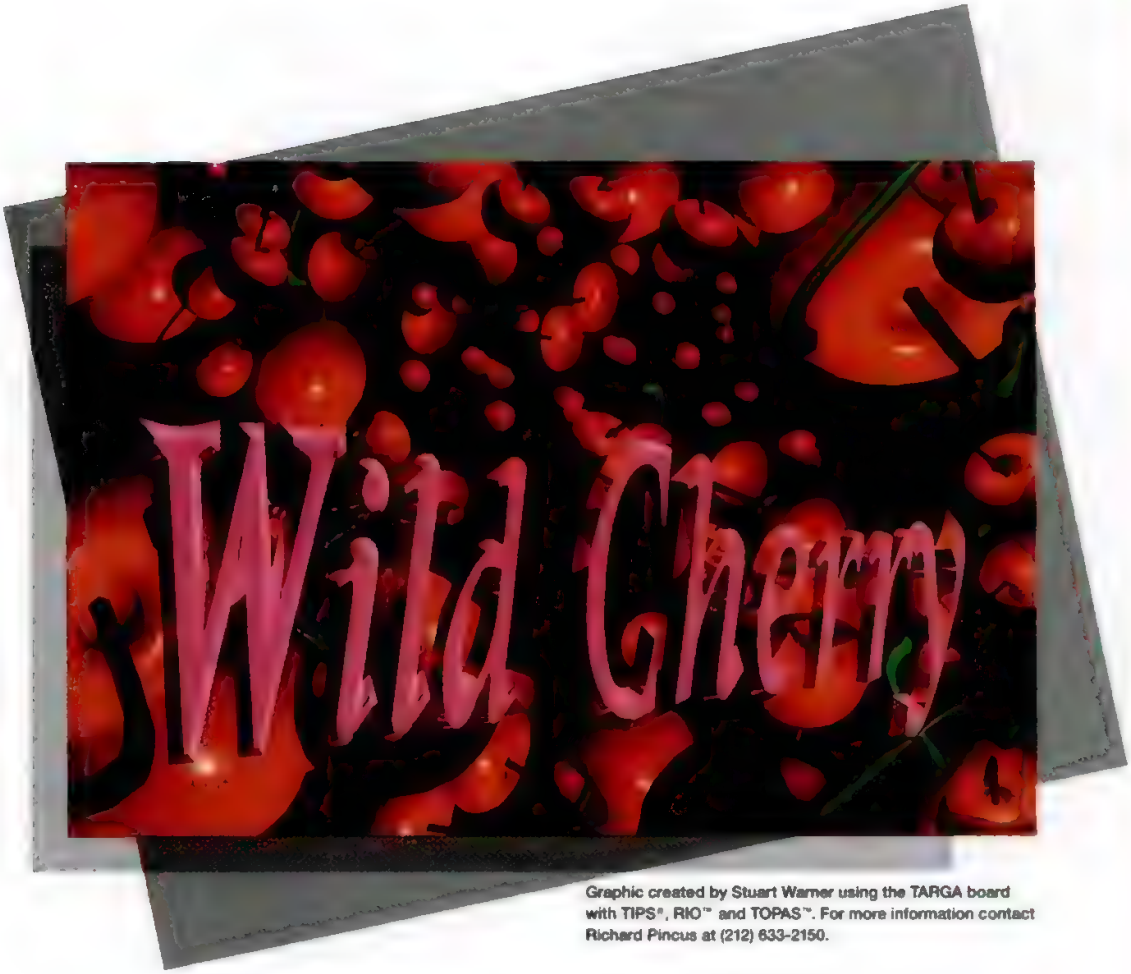
CIRCLE **547** ON READER SERVICE CARD

MEMORY CHOICES

All system memory goes on a card that plugs into the motherboard's 32-bit slot. Be aware that there are two memory cards available; one takes a maximum of 8MB of DIP RAM and the other takes a maximum of sixteen 1MB SIMMs. Our review unit came with the DIP memory card, with 4MB of RAM in the form of 1MB chips. However, if you buy this system, it is a good idea to get the SIMM card instead. It costs only $65 more and the price of RAM is the same for either DIP or SIMM memory.

In addition to the 32-bit memory slot, the motherboard provides two 8-bit slots and five 16-bit slots. On our review unit, three of these were filled with the Paradise Super VGA card, the Data Technology Corp. DTC 6280 ESDI disk controller, and the parallel-serial card. Also, one slot was blocked by the second serial port and game port, which attach to the parallel-serial card. This left our review unit with a paltry three slots free for expansion. According to Blue Star, there is an alternative I/O card that takes advantage of the connector cutouts on the back of the sys-

"Time is money and I'm saving both with TARGA."



Graphic created by Stuart Warner using the TARGA board with TIPS®, RIO™ and TOPAS™. For more information contact Richard Pincus at (212) 633-2150.

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Blue Star 80386-33, $3,849

tem to free up a slot. Be sure to specify the AT I/O Plus card if you order this system.

The Blue Star's desktop case measures 6.5 by 19.3 by 17 inches. It has the usual drive bay arrangement of three half-height bays plus two—with three bays accessible with the cover on. Four of the bays were filled with the full-height 150MB Seagate drive and two half-height Toshiba floppy drives, leaving just one bay for expansion.

One of the Blue Star 80386-33's strongest advantages is its service and support. The system comes with a five-year warranty for the motherboard and memory and a one-year warranty for everything else. Support includes phone service with parts shipping, back-up on-site service through TRW, and the option to return the unit to your dealer or to Blue Star Marketing for repair.

The Blue Star 80386-33 turned in lackluster results on PC Labs benchmark tests. In nearly every case it performed below average. The one exception was the video test scores, which were slightly better than average.

The bottom line? The Blue Star 80386-33's average performance matches the machine's average price. It's hard to recommend unless you can get it for well under its list price. The service and support policies are an inarguable strength, but they are counterbalanced by the merely adequate performance and the somewhat limited room for expansion.

Brain Computer Corp.

The Brain 386-33

by Bruce Brown

If you wouldn't mind other people pointing to your computer and referring to it as "The Brain" in your office, you might want to take a look at this 33-MHz machine. The Brain 386-33 is overall a decent performer, with the added plus of a hot video board with 1MB of video RAM and the excellent Tseng ET4000 chip set. The only drawback to the reasonably-priced Brain machine is its full-size desktop case with rough finished support pieces and relatively limited drive expansion room.

Our $3,820 test system came with 4MB RAM, a 32K processor RAM cache, a Seagate/CDC/Imprimis 160MB, 16-millisecond IDE hard disk, and both 1.2MB and 1.44MB Chinon floppy disk drives. The Tseng video board pairs well with the NEC 2A 800-by-600 Super VGA monitor. Also included in the system price are a Unitek 101-key keyboard, one parallel, one game, and two serial ports, and DOS 4.01.

The Brain system uses a Cache brand motherboard with an OPTI 386 chip set that incorporates the processor RAM cache controller internally. The RAM cache comes standard with 64K of 25-nanosecond SRAM, but that can be increased to 128K. The system uses AMI ROM BIOS chips with video and system ROM BIOS shadowing, both selectable through the CMOS setup program. There's a single socket to handle either an 80387 33-MHz math coprocessor or a Weitek 3167 unit.

While the company sells a system with as little as 1MB on board, the Brain's motherboard has sockets for a full 16MB of RAM. Our tested unit had 60-ns. chips installed, but even 80-ns. chips should achieve the same results with the RAM cache and the motherboard's interleaved page-mode circuitry.

The Brain 386-33
Brain Computer Corp., 10000 Old Katy Rd., Houston, TX 77055; (800) 488-2468, (713) 935-3638.
List Price: With 1MB RAM, 64K RAM cache, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive, VGA video adapter, monochrome VGA monitor, one game, one parallel, and two serial ports, $2,515; as tested with 4MB RAM 160MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA display adapter, NEC 2A Super VGA color display, DOS 4.01, $3,820.
In Short: The Brain 386-33 desktop machine, appropriate for a single-user computer, offers good performance, a decent price, average drive expansion room, and standard on-site service.

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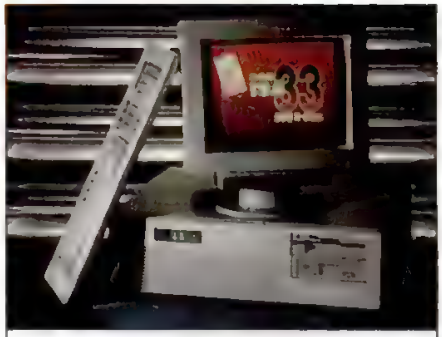

The Brain 386-33, $3,820

The system's performance on the video benchmark tests was among the top quarter of machines reviewed here. Its processor test scores were slightly below average, but that was balanced by the above average Conventional Memory test results. The small-record DOS File Access test score was about average, as was the BIOS Disk Seek score; however, the large-record DOS File Access time was among the slowest.

The Brain 386-33 case is a standard AT-style unit with the power switch on the right side and the reset button and keyboard lock on the front. It measures 6.5 by 21 by 16.8 inches, and has space for five half-height 5.25-inch drives, three of which can use removable storage media. Five drives is probably enough for most single users, but they'd probably rather see them packaged in a more appropriate small-footprint case. Additionally, the Powertronic 200-watt power supply has only four device power leads.

Inside The Brain 386-33 are two 8-bit slots and six 16-bit slots. In our test unit, after the video adapter and the combination IDE drive interface and I/O card were installed, six slots were free. That's one more than average for most computers in this category, and there's the added advantage of not having to take up any of them with memory cards.

Brain Computer is a relatively new company, founded earlier this year. It sells directly via telephone and mail order and through a limited direct sales force to corporate accounts. The standard one-year parts-and-labor warranty is backed by free on-site service from General Electric. There's also a 30-day money-back guarantee.

It's hard to ignore the appeal of the system's excellent video performance and overall decent benchmark test scores, as well as its motherboard memory, expan-

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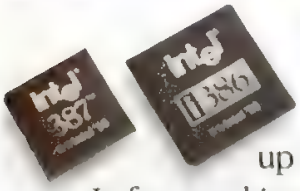

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sion slot capacity, and low price. The Brain is a system to consider—particularly if you can get it in a small-footprint case.

BSI

BSI 386-33

by M. David Stone

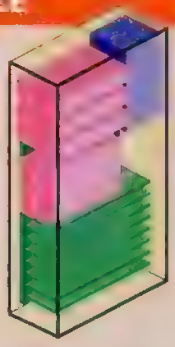
The BSI 386-33's $3,319 standard configuration list price may be one of the least expensive in this review, but here low price does not mean low performance. In selected tests, the 386-33 performed in the top tier of all machines reviewed and scored better than average overall.

For this review, BSI supplied us with a system that included a BSI Super VGA card and a TVM SuperSync monitor (both capable of up to 1,024-by-768 resolution), 4MB of RAM, 64K of 25-nanosecond cache (which can be upgraded to 256K), a 1.2MB floppy disk drive, a 16-millisecond 158MB Micropolis hard disk, a Fujitsu 101-key keyboard, one parallel, one game, and two serial ports, and DOS 4.01. You can substitute a 1.44MB drive for the 1.2MB unit for the same price.

BSI 386-33, $3,319

Our review machine came with a 21.5- by 7.3- by 19-inch tower case. The company's $1,839 basic configuration—with 1MB of RAM, a 64K cache, 40MB hard disk, and Hercules-compatible card and monitor—comes in an AT-style case. However, there is little practical difference between the two, since both have five half-height drive bays, three of which are accessible with the cover on. In our review unit, two bays were filled with the Panasonic floppy disk drive and Micropolis hard disk. The three remaining bays may be enough for a network or power user, but just barely.

FACT FILE



BSI 386-33
BSI, 9440 Telstar Avenue, #4, El Monte, CA, 91731; (800) 872-4547, (818) 442-0020.
List Price: With 1MB RAM, 64K cache RAM, 40MB hard drive, 1.2MB or 1.44MB floppy disk drive, Hercules-compatible monochrome display, one parallel, two serial, and one game port, DOS 3.3 or 4.01, $1,839; with 4MB RAM, 158MB hard disk, Super VGA color display, $3,319.
In Short: Better than average overall performance at a lower-than-average price. Both desktop and tower cases have just five half-height drive bays, which somewhat limits expansion. However, this is still a reasonable choice for those on a budget.

CIRCLE 549 ON READER SERVICE CARD

SOLID AND STANDARD

The construction provides solid support for the Datatech Enterprises motherboard, without any flexing at all. The motherboard houses the 80386/33, the AMI BIOS, a coprocessor socket for an 80387 or Weitek 3167, and a combination of discrete logic plus one chip from the VLSI chip set. Elsewhere on the PC's motherboard are eight SIMM sockets. Anything over 8MB of RAM goes on a memory board that allows a system maximum of 16MB.

The 32-bit memory slot can also function as an 8-bit slot. In addition, the motherboard offers six 16-bit slots and one 8-bit slot, for a typical eight-slot total. On the review unit, three slots were filled with the Super VGA card, the disk controller card, and a serial-parallel card. Yet another slot was tied up with the game port and second serial port attached to the serial-parallel board by ribbon cable. However, according to BSI, you can avoid tying up a slot by getting cables that go to the additional connector cutouts on the back panel. If you buy this unit, be sure to order it that way.

On PC Labs' processor and memory benchmark tests and on the disk tests, scores varied from among the best of the field to slightly below average. The video scores were midrange or below. That can't take away from the fact that the performance is more than you might expect for the price.

The one-year warranty for parts and service includes phone support with parts shipping, as well as the usual option to return the unit to the manufacturer or dealer.

If price is no object, you can easily find systems with better performance or more expandability, but the BSI 386-33 offers a combination of price, performance, and support that makes it a more than reasonable choice. If you're on a budget, you'll find that this is a lot of computer for the price.

CAF Technology Inc.

CAF Master 386C/33T

by M. David Stone

If money's tight and you're willing to live with a few limitations, the CAF Master 386C/33T from CAF Technology provides a way to get into the 33-MHz game at a budget price. The machine offers a mix of features that include a tower case, more drive bays but fewer slots than usual, a notably low price and, unfortunately, lower than average performance.

CAF's version of the *PC Magazine* standard configuration is just $3,079. Included at this price is 4MB RAM, 64K of 25-nanosecond cache, a 150MB hard disk, a 1.2MB floppy disk drive, a Hisland Super VGA card and ADI monitor (both with up to 1,024-by-768 resolution), a Fujitsu 101-key keyboard, one parallel, one game, and two serial ports, and DOS 4.01. You can substitute a 1.44MB floppy disk drive at the same price. Our review unit added a second floppy disk drive for a system price of $3,179. And for those who like to start with a stripped-down

CAF Master 386C/33T, $3,179

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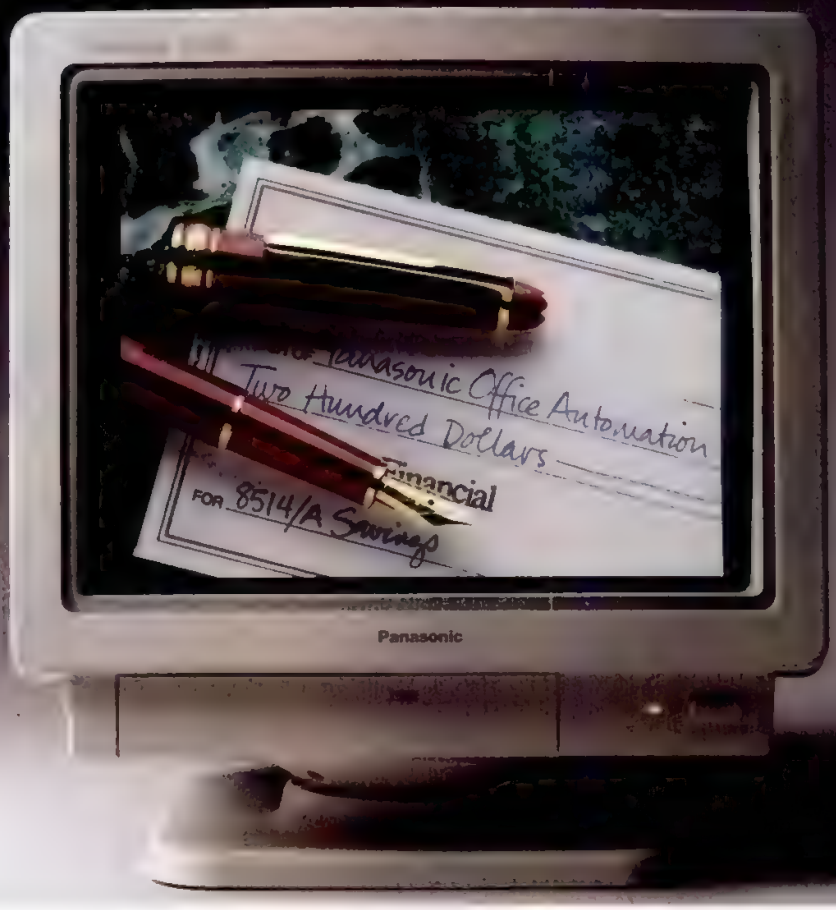

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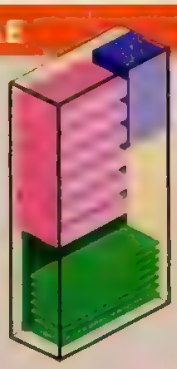

CAF Master 386C/33T
CAF Technology Inc., 600 South Date Ave., Alhambra, CA, 91803; (800) 289-8299, (818) 289-8299.
List Price: With 1MB RAM, 64K cache RAM, 1.2MB or 1.44MB floppy disk drive, one parallel, one game, and two serial ports, $1,575; with 4MB RAM, 150MB hard disk, Super VGA display, $3,179.
In Short: A reasonable choice for those on a tight budget, the CAF Master offers a low price, a tower case, and six easily-accessible half-height drive bays. Alas, system performance is on the low side of average, and expandability is slightly limited by having only seven slots on the motherboard.

CIRCLE 550 ON READER SERVICE CARD

system, $1,575 will get you the same case and keyboard with 1MB RAM, 64K cache, one floppy disk drive, one parallel, one game, and two serial ports. All prices include a one-year warranty and phone service with parts shipping, though the only backup to the phone service is to return the system to CAF.

The 24.5- by 7.5- by 17-inch (HWD) tower offers reasonably solid construction, though there is a slight flexing with the cover off. Under the category of intelligent design, you'll find six half-height drive bays in a single stack, so that you can fill them with any combination of half-height or full height drives. And since all six bays are accessible with the cover on, there is plenty of room for such additions as Bernoulli drives, tape drives, or optical drives. Alas, you may run out of expansion slots before you run out of bays because the CAF Technology motherboard has only seven slots.

Only two of our review unit's slots were filled, one with the Hisland Super VGA card and the other with a Western Digital ESDI controller card. A third slot should have been filled with the parallel-serial card, except that CAF accidentally shipped the system without one. Additional connectors cabled to the card do not block another slot, since there is an extra slot cover on the back panel. Of the four remaining slots, one can function as either a 16-bit or a 32-bit memory card slot. If you want to upgrade the system to its full 16MB, you only have three slots left for expansion. Add a tape drive, a fax board, and a bus mouse, and you've filled this system to capacity.

The CAF Technology motherboard provides eight SIMM sockets for up to 8MB of RAM. On our review unit, four of these were filled with 70-ns. SIMMs, yielding the 4MB total. The motherboard also held the 33-MHz 80386 processor, 64K cache RAM, AMI BIOS, a socket for an 80387 coprocessor, and discrete logic serving for both system and cache control.

Performance was lower than average. Although the system scored well on the memory test, all other results were well off pace. In general, it scored significantly better than the worst performers, but significantly worse than the best.

All told, the CAF Master 386C/33T cuts a few corners (particularly in leaving out the eighth slot), but it avoids any truly fatal flaws and may be just the machine for those on a tight budget.

Clone Computers

Clone 386-33C

by M. David Stone

If you think of a clone computer as a generic term with a lowercase *c*, you've probably never seen a system from Clone Computers. Consider, for example, its Clone 386-33C, a unit that delivers high-quality construction, more drive bays than most, better-than-average performance, and a *PC Magazine* standard configuration list price of only $3,684.

The mini-tower case that is included in this price is actually a $75 upgrade from a desktop case; while you can get the latter, Clone says that the mini-tower is more representative of its 386 sales. Our review machine also included 4MB of 70-nanosecond RAM, 64K of 25-ns. cache, a 160MB Imprimus hard disk, an STB Systems Super VGA card and Liton monitor (both with resolutions up to 1,024-by-768), a Focus Electronics 101-key keyboard, one parallel, one game, and two serial ports, DOS 4.01, and *Windows* 3.0. Note that our review unit lists for $3,763 because of the presence of a second floppy disk drive. Clone does provide a $1,599 base model for those who prefer to start with a stripped-down system—it includes only the desktop case, a keyboard, 1MB RAM, a 64K cache, one floppy disk drive, and one parallel, one game, and two serial ports.

Clone 386-33C, $3,684

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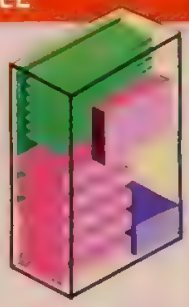


Clone 386-33C
Clone Computers, 2544 West Commerce St., Dallas, TX, 75212; (800) 527-0347, (214) 637-5400.
List Price: With 1MB RAM, 64K cache RAM, 1.2MB or 1.44MB floppy disk drive, one parallel, one game, and one serial port, $1,599; with 4MB RAM, 160MB hard disk, Super VGA display, DOS 4.01, $3,684; 1.2MB and 1.44MB floppy disk drive, $3,763.
In Short: High-quality construction, a mini-tower case with six half-height drive bays, better-than-average performance, and a mid-range price add up to a Clone computer that is well worth considering.

CIRCLE 602 ON READER SERVICE CARD

DRIVE DESIGN TWIST

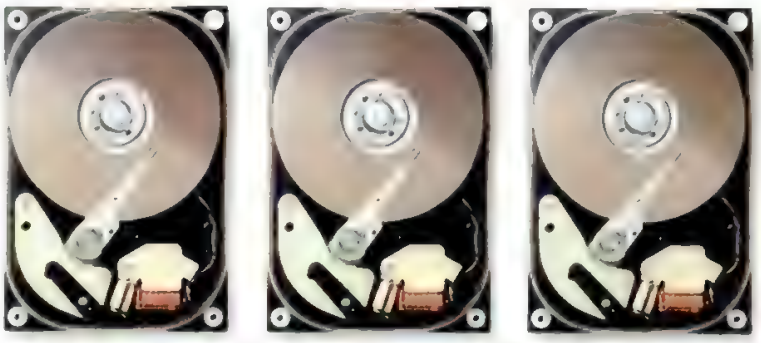
The 15.8- by 8.8- by 20-inch mini-tower case provides some very attractive details, such as high-quality construction and a second fan that, in addition to the fan on the power supply, helps keep temperatures low and so prolongs component life. An interesting design twist is the way the case provides for up to six drives. In addition to five half-height bays in the front, all in one stack, there is a rail for mounting one half-height drive vertically, next to the expansion cards. The positioning means you have to remove the drive to get at the cards, but for most people, this isn't an issue.

Our review unit's Mek-Fab motherboard contained an 80386-33 processor, AMI BIOS, a combination chip set and cache controller from OPTI, a 64K cache, and a coprocessor socket that supports an

IT HAS BEEN
BROUGHT TO
OUR ATTENTION
THAT NOT EVERYONE
BELIEVES
PORTABLE PCS
CAN BE AS
FUNCTIONAL AS
DESKTOP PCS.

THIS SHOULD

This may be hard to believe, but there really is such a thing as a portable PC that can do everything a conventional desktop can.

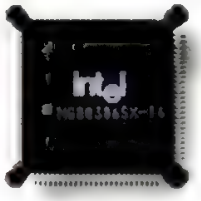


Some people can't imagine squeezing a 40, 100 or even a 200MB hard disk into a portable PC. But when they take advantage of all that storage capacity, they find it hard to imagine life without it.

In fact, there's not just one, but an entire line of them. They're called Toshiba Portable Desktops,™ and they'll forever change the way your company looks at power and productivity.

To get more information or a free Portable Desktop productivity survey, call 1-800-477-1616.

True, some business people may have trouble grasping the notion of desktop power in a portable, but when you give it some thought, it's the next logical step in computers.



There once was a day when microprocessors this powerful were unheard of in a portable. Luckily for people who crave raw power and computing speed, that day is over.

With 386™ and 386™SX microprocessors, our Portable Desk-

For those who think a PC just isn't fully functional without a color display, we developed our second-generation LCD color screen. For those who think basic is better, our VGA gas plasma systems have the perfect displays.

REMOVE ALL DOUBT.

To anybody who doesn't expect a portable PC to have IBM®-compatible expansion slots, we have just one thing to say. Raise your expectations.

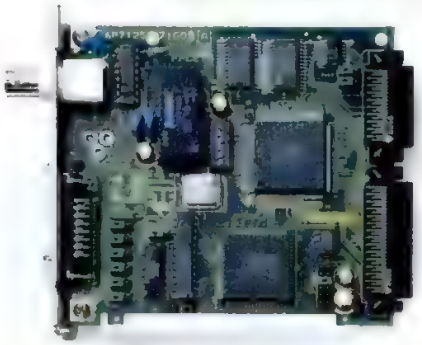
tops run all of the same applications as your company's conventional PCs. With hard disk drives from 40 to 200MB, you have all the flexibility to configure a system the way you want it.

Anyone who insists portable PC users are doomed to cramped, undersized keyboards hasn't gotten their hands on a Toshiba. We use standard-size keys and standardized key spacing so your hands will feel right at home.

With the connectivity of our multiple expansion slots and ports, our Portable Desktops fit right in with your existing system and grow as your company grows.

They say you can't squeeze much memory into a portable PC. But considering that our dedicated memory expansion slots let you add up to 12MB of RAM as your need for power grows, it looks like "they" were wrong again.

And to remove the last possible barrier between your needs and our portables, we've even designed one with a high-resolution VGA color screen.



With an expansion slot for a LAN card, you get complete networking freedom without giving up all your other expansion slots.

In other words, it really is possible to have all the capabilities of a conventional desktop in a portable.

All you have to do is try one. And believe.

T5200. 386 microprocessor, 40, 100 or 200MB HDD, 2 to 14MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated memory slots), VGA plasma display.

T5200C. 386 microprocessor, 200MB HDD, 2 to 14MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated memory slots), VGA passive matrix color LCD display.

T3200SX. 386SX microprocessor, 40 or 120MB HDD, 1 to 13MB RAM, 2 IBM-compatible expansion slots (in addition to dedicated modem and memory slots), VGA plasma display.

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Giving your people instant access to vital information can keep them doing what they do best. Working smart.

Then your key employees can turn after-hours time into productive time, since their dining room tables and breakfast nooks can serve as off-site workstations.

Employees can even improve their productivity in the familiar surroundings of their own office. Only now they'll have more desk space to work with.

Your top people can add impact to their presentations with a wealth of information and computing power at their fingertips. And the story can repeat itself—with equally impressive results—everywhere from an office 3,000 miles away to a conference room that's a mere 30 feet down the hall.

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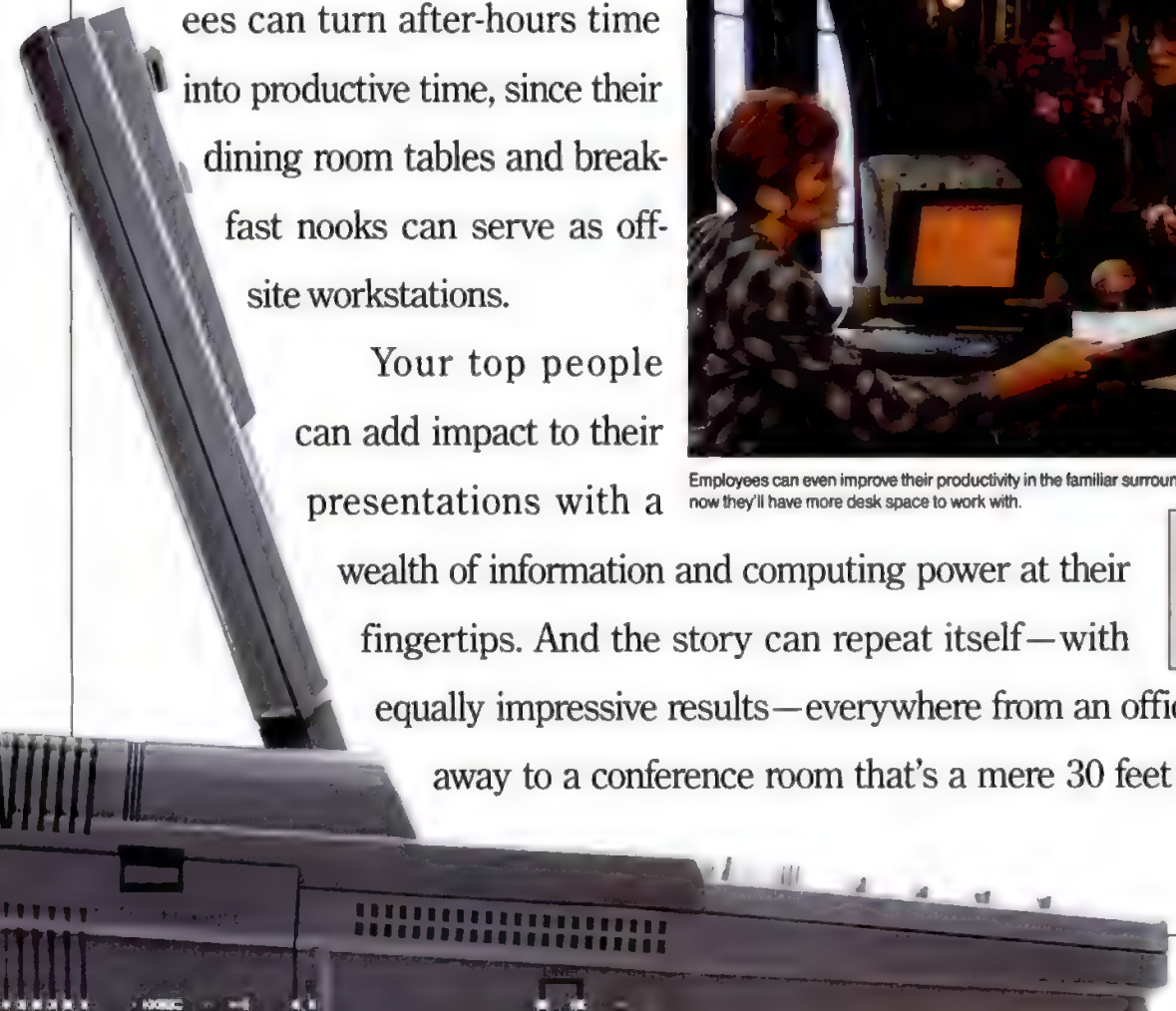

WHERE DO YOU GO FROM HERE?

Giving your key employees a Portable Desktop means they'll have the flexibility to work when they need to, where they want to.

And yes, all that productivity can even take place within the confines of your own office desk (while using up considerably less of your desk space, we might add).

When people have access to computing power outside their office, presentations are more powerful and groups are more productive.

All of which leads us to one very powerful observation.

Now all of your best people can be doing a better job than they ever could when they were chained to conventional desktop PCs.

Better yet, they can do it without sacrificing power, functionability or expandability. Or anything else, for that matter.

THREE POWERFUL ARGUMENTS WHY YOUR NEXT

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In Touch with Tomorrow

TOSHIBA

Toshiba America Information Systems Inc., Computer Systems Division.

CIRCLE 379 ON READER SERVICE CARD

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80387, Weitek 3167, or both on a Weitek daughterboard. The motherboard also had eight slots and eight SIMM sockets; four sockets were filled with 1MB SIMM models. If you need more than 8MB, you have to get a 32-bit memory card, which will let you raise the system total to a maximum of 16MB. According to Clone Computers, the memory card uses DIP-type RAM.

The system slots include one 8-bit and six 16-bit slots, and a 32-bit memory slot that can also serve as an 8-bit slot. On our review system, three slots were filled, one with the Super VGA card, another with a Western Digital ESDI disk controller, and the third with the I/O card with one serial port and the game port. Connectors for the parallel port and second serial port are mounted in the connector cutouts on the back panel.

To say that the Clone 386-33C's performance is respectable is something of an understatement. On PC Labs' benchmark tests, the Clone 386-33C scored far better than average overall. It was one of the best performers on the video tests and the memory test and was not far off the mark on the processor tests. The machine achieved some of the best disk test scores, if you ignore systems with caching controllers.

At this writing, Clone's one-year warranty is limited to phone support with parts shipping and return to the manufacturer if necessary. However, by the time this is published, Clone expects to have on-site service available as a backup to phone support. One nice touch is that the warranty can be extended to five years for a relatively low premium ($649 for the review unit).

The Clone rates as a high-quality package, and it will become even more so once the on-site service is added. The combination of performance, quality construction, support, and price is rare. And that makes it well worth your attention.

CompuAdd Corp.

CompuAdd 333T

by M. David Stone

By any measure, the CompuAdd 333T from CompuAdd Corp. qualifies as a heavy-duty system for serious computing. Whether you're looking for lots of drive bays, plenty of free slots for expansion, quality construction, uniformly fast performance, or an FCC Class B rating, the 333T has it. Even better, this full-size tower offers all these features at a nearly midrange price of $5,975 for the *PC Magazine* standard configuration.

Our tested configuration included 4MB of 80-nanosecond RAM, 64K of 15-ns. cached RAM, a 150MB Seagate hard disk, 1.2MB and 1.44MB floppy disk drives, a CompuAdd Hi-Rez VGA card and a Seiko CM 1440 Super VGA monitor (both with up to 1,024-by-768 interlaced resolution), a Mitsumi 101-key keyboard, one parallel and two serial ports, DOS 4.01, and *Windows* 3.0. The system also came with 1,024K RAM on the video card rather than the usual 512K, increasing the system's price to $6,024. All prices include one-year on-site service through Memorex-Telex.

(UN)CONVENTIONAL SRAM

The CompuAdd 333T features an SRAM board that provides 640K of 25-ns. SRAM as conventional memory. While the system comes in its stripped down version without the board, CompuAdd says that the motherboard was in fact designed around the SRAM, and that it is considered an integral part of the system. In any case, the board is included in the CompuAdd package that most closely matches our standard configuration, and we included it as part of the review unit.

Similarly, the company says that the motherboard is also designed around CompuAdd's caching controller. Not only does the controller provide caching for the disk drive, it operates at the equivalent of 12.5 MHz, but only in a specially designed hot slot. The bus speed is 8 MHz, but setting a jumper changes the wait state setting for the hot slot, yielding the equivalent of 12.5 MHz. Here again, because the hot slot and caching controller are central to the system design, we allowed the controller as part of the review unit. (The motherboard also has a second hot slot for the CompuAdd video card.)

On the PC Labs benchmark tests, the 333T handed in just the kind of performance you would expect from the SRAM card and the caching controller. It is certainly among the fastest of the 33-MHz machines we've tested. It scored the best time in the group, or close to it, on every test we put it through, boasting the best overall performance in the field.

Performance isn't the 333T's only virtue. The case, for example, features quality construction throughout. And the 25.8- by 8- by 19-inch tower design leaves ample room for expansion. Our review system had four half-height bays filled with a full height 150MB hard disk and two floppy drives, and there were still five empty bays left over. The nine half-height bays come in one stack of six and one of three.

CompuAdd 333T, $5,975

CompuAdd's motherboard also houses the 33-MHz 80386, the Phoenix BIOS, 64K cache, a coprocessor socket for an 80387 or Weitek 3167, and discrete logic serving for the chipset and cache controller. Also on the motherboard are the slot for the SRAM board, six 16-bit slots, one 8-bit slot, and a dedicated 32-bit memory slot. The memory board has 16 SIMM sockets, for a maximum of 16MB. Four

FACT FILE

EDITOR'S CHOICE

CompuAdd 333T
CompuAdd Corp., 12303 Technology Blvd., Austin, TX, 78727; (800) 627-1967,(512)258-5575.
List Price: With 4MB RAM, 64K cache RAM, 1.2MB or 1.44MB floppy disk drive, one parallel and two serial ports, DOS 4.01, *Windows* 3.0, $2,775; with 640K SRAM, 153MB hard disk, 1.2MB and 1.44MB floppy disk drive, Super VGA display, 1MB hard disk cache, $5,975; with 1,024K on VGA card, $6,024.
In Short: A speed demon, one secret to the CompuAdd 333T's success is its use of ultra-fast static RAM. Quality construction, superior expandability, one-year on-site service, and an FCC Class B rating make this system one of your best bets.

CIRCLE **603** ON READER SERVICE CARD

MAG COMPUTRONIC INC.

MAG Computronic PMV14VC Plus

by Alfred Poor

One of the great advantages of *PC Magazine*'s reviews is that we go beyond just the few "big name" products and include every relevant contender. While this often produces just another thorough investigation that includes many "me-too" big-name machines or programs, we sometimes uncover some real finds, like the MAG Computronic PMV14VC Plus color monitor [illegible]

This Mag monitor can display up to 1024 by 768 resolution in an 8514/A-compatible interlaced mode. It also carries the impressively low list price of $635.

The price is only part of the monitor's attraction. The image it displays is quite smooth and crisp. Part of the quality may be a result of its fine dot pitch (0.28 mm), but that can only be part of the story.

The image on our test machine appeared to have no areas of serious misconvergence—the white lines of our test image were consistently white, without colored halos even in the corners. The pincushioning measurements were some of the lowest among all the monitors we tested, and the line widths were fairly thin and consistent between center and between horizontal and vertical orientations. The convergence tests showed this to be one of the most stable displays in the group.

The PMV14VC Plus did an excellent job of maintaining the correct image size when switching between different resolutions. The monitor is a multiple-frequency design, capable of syncing on horizontal scan rates between 30 and 36 kHz.

If the MAG Computronic monitor has a problem, it is with its controls. The tilt/swivel base has the standard brightness and contrast controls mounted on the lower-right front corner. The power switch is located in the back and is rather small.

Even more significant is the fact that there are only two picture size and position controls instead of the more typical four. There is a horizontal position control (labeled "H Phase") and a vertical size control. Instead of being located in the front where you can reach them while you see their effect on the screen, these controls are in the back, with the power switch, so you must struggle to find them when adjustments are necessary. The power-switch problem can be solved with a power strip, but the control issue is more difficult. Fortunately, the PMV14VC Plus holds its image size well between resolutions, so it's possible you won't need to fiddle with the picture controls frequently.

The MAG Computronic PMV14VC Plus has its flaws, but given its aggressive price and excellent image, it has to be one of the most attractive values in this group.

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■AT Case with 200w Power
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MONO $1,249
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VGA NONCACHE $2,599
MONO CACHE $2,249
MONO NONCACHE $2,099
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■1:1 HD/FD Controller
■Magicsync 1024 x 768 Monitor
■ATI 1024 x 768 512k VGA Card
■Teac 1.2MB and 1.44MB Drive
■101 Key Keyboard
■2 Serial, 1 Parallel, 1 Game
■7-Bay Vertical Case w/220w
■One Year GE On-Site Service
■256k Cache Memory Optional

64K CACHE 33 MHZ 386 VGA
80386-33 CPU
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■155MB 17MS Hard Disk
■ESDI Controller w/32k Cache
■Magicsync 1024 x 768 Monitor
■ATI 1024 x 768 512k VGA Card
■Teac 1.2MB and 1.44MB Drive
■101 Key Keyboard
■2 Serial, 1 Parallel, 1 Game
■7-Bay Vertical Case w/220w
■One Year GE On-Site Service
■256k Cache Memory Optional

64K CACHE 25 MHZ 486 VGA
80486-25 CPU
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MONO $3,949
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■155MB 17MS Hard Disk
■ESDI Controller w/32k Cache
■Magicsync 1024 x 768 Monitor
■ATI 1024 x 768 512k VGA Carkd
■Teac 1.2MB and 1.44MB Drive
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Terribly Fast BUS COMPUTER SYSTEMS INC.

1MB SIMM modules on our review system, plus the 640K SRAM board, brought the system up to a total of 4,736 kilobits of RAM. Even with the memory board, VGA card, and disk controller installed, the 333T still has five free slots, thanks to an extension to the motherboard that includes the parallel port and two serial ports.

Its obvious that there is a lot to like here and very little to dislike. About the only trick CompuAdd missed is providing support for both the Weitek and the 80387, but that won't be an issue for most users. Whether you're looking for a network server or a power user's dream machine, this combination of performance, quality construction, and expandability will be hard to beat at any reasonable price.

Computer Marketplace Inc.

Ultra 386C-33

by Fredric Burke

People at PC Labs walked around the jet-black Ultra 386C-33, humming a familiar movie score. Indeed, the way the Ultra dwarfed PCs of lesser stature made it

Ultra 386C-33, $3,995

resemble the monolith from the movie *2001: A Space Odyssey*. Now, imagine putting that monolith to use, configuring it exactly, not giving up any performance, and still spending less than expected. This accurately describes the Ultra 386C-33, which had a tested version at the bargain price of $3,995.

If you can tear your eyes away from the solidly constructed, imposing black case measuring 23- by 7.5- by 18-inches (HWD), you should look inside. Computer Marketplace's emphasis on configuring machines to personal preference does not extend to offering shoddy components. The only real complaint to be lodged against the machine is the way it is finished inside; loose, knotted, and sloppily tie-wrapped cabling and wires detract from an otherwise professional job. The low price is no excuse and according to the company, the factory is now in the process of rectifying it.

> In a nice display of nonstandard support behavior, Computer Marketplace offers a full two-year parts-and-labor warranty.

Orchid Technology provides the motherboard, VLSI the chip set, and AMI the BIOS, which can be shadowed in both the video and system modes. Expansion capabilities are more than adequately handled, with two 8-bit and five 16-bit slots, plus a 32-bit slot for a proprietary memory board. The motherboard also supports either an 80387 or Weitek 3167 coprocessor chip, though not concurrently.

In a move that is rapidly becoming a standard for machines of this class, the Ultra offers an Intel 32K disk cache, consisting of four 8K chips. Unlike other systems, the Ultra's cache cannot be altered in any way, but performance is anything but downgraded. The 386C-33 stayed well into the top third of the machines PC Labs tested, proving that top speed does not necessarily require top dollar.

The Ultra 386C-33's tested version came with 4MB of RAM, expandable to 8MB on the motherboard, packaged in 1MB 80-nanosecond DRAM. An available $129 proprietary 32-bit add-in board will allow you to boost RAM up another 8MB. Upgrades to 2, 4, 8, and 16MB are $149, $298, $596, and $1,192, respectively. Here lies a weak spot for the Ultra—power users utilizing CAD or DTP programs will be right at the edge of their RAM limits. Though its current RAM allotment can hardly be considered a liability, this machine needs more RAM capability if it is to meet these specialized needs.

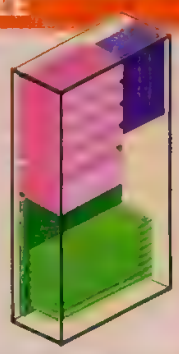
In terms of mass storage, the 386C-33 has things more adequately covered. The system can have a 1.4GB hard disk installed, though at nearly the price of the machine as tested. More down-to-earth hard disk options exist. The tested version came with a Micropolis 150MB hard disk, with an integrated Western Digital controller for the TEAC 1.2MB floppy and the Toshiba 1.44MB floppy. Also available is a 32K Conan cache controller, though it was not installed on the tested unit.

The Ultra also featured PC Power and Cooling's excellent 300-watt power supply, as well as a crisp CTX Super VGA monitor. Deserving special mention is the Focus Electronics FK-5001 keyboard. The 386C-33 also came generously endowed with software, featuring DOS 4.01 and *Windows* 3.0 with a Microsoft serial mouse.

Computer Marketplace also doesn't ignore the service aspect of its business: In a nice display of nonstandard support behavior, the company offers a full two-year parts-and-labor warranty with Phoenix Service Technology as its on-site service agent.

Computer Marketplace has put together a remarkably competent machine for the price. As a total package of possible configurations, price, and support, the Ultra 386C-33 can please even the most jaundiced PC buyer. It's a machine worthy of your consideration.

FACT FILE



Ultra 386C-33
Computer Marketplace Inc., 450 Pkwy., #202, Broomall, PA 19008; (800) 345-7397.
List Price: With 1MB RAM, 64K cache RAM, 1.2MB floppy disk drive, 40MB hard disk, monochrome monitor, one parallel and two serial ports, DOS 4.01, $1,809; with 4MB RAM, 150MB hard disk, 1.2MB and 1.44MB floppy disk drives, Super VGA monitor, $3,995.
In Short: A sleeper. The Ultra's performance easily keeps up with the class; a real bargain. The black tower makes a strong statement, but inside the Ultra needs some help with the small details. Otherwise, a worthy consideration.

CIRCLE 601 ON READER SERVICE CARD

Core International

Core 386/33

by Fredric Burke

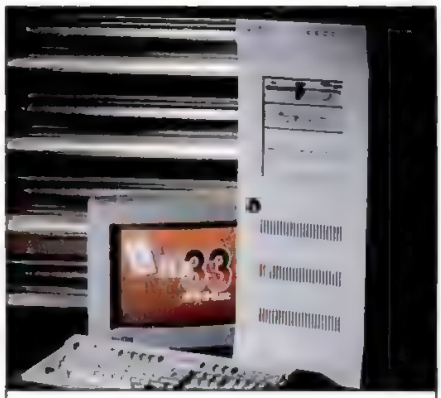
Core has long been a power player in the PC game. Its latest machine, the Core 386/33, continues in that tradition. Though somewhat pricey at $10,785 in *PC Magazine*'s standard configuration (4MB RAM, a 64K disk cache, a 150MB Core ESDI hard disk and integrated hard/floppy drive controller card, TEAC's 1.2MB floppy disk drive, Mitsubishi's 1.44MB floppy drive, a VGA monitor, and one parallel and two serial ports), the Core 386/33 is a big, brawny machine endowed with lots of room for expansion and the speed to make it all work. As a file server or CAD platform, the Core 386/33's abilities are every bit as good, if not better, than many of its competitors.

Core has the basics down right. Inside the rugged 386/33's 23- by 9- by 24-inch (HWD) tower case, Core has installed a Micronics motherboard. Chips and Technologies provides the chip set, and Phoenix the BIOS that can shadow in both video and system modes.

Core's own motherboard recognizes the need for expansion by intelligently providing two 8-bit and five 16-bit slots. It also has an additional slot for a proprietary 32-bit memory expansion card. The slots are mounted at the top of the motherboard and getting to them is a fairly simple exercise. As configured for the benchmark tests, with video card, floppy controllers and I/O, there still remained five slots, though two were of the less handy 8-bit variety. The Core 386/33 also provides for an 80387 or Weitek 3167 math coprocessor.

Core's quest for breakneck performance accounts for the built-in 64K cache, using an Intel chip set. Since memory is always an issue with power users, the 4MB of RAM provided in the test system is also a feature echoed in the most basic configuration of the 386/33 (which does not, however, include a hard disk). RAM can be expanded to 16MB, employing 1MB SIMM chips rated at 80ns. RAM can be boosted a further 8MB—using 1MB DPS chips—by installing the memory expansion card.

Further reinforcing the idea of the 386/33 as a file server, Core makes provisions in the tower configuration for up to ten half-height drives to be installed within the chassis, though at the cost of precious 16-bit slots for the interface cards. A good selection of Core's own tape drives is available, ranging in capacity from 150MB to 2GB.



Core 386/33, $10,785

The 386/33 more than meets its video needs; Paradise provides both the 16-bit card and chip set for the VGA system, while a very good Mitsubishi monitor handles output duties. Rounding out the impressive specifications of the 386/33 is a powerful 250-watt, switchable Skynet power supply and a superb Focus Electronics keyboard, one of the nicest keyboards around.

The unit doesn't provide a mouse, as Core does not bundle *Windows* with the machine, though it does include an expanded memory manager, some disk utilities, partitioning software, and Novell, OS/2, and Xenix drivers. The relatively high price of the Core 386/33 does not include any operating software, though DOS 4.01 can be bought for $119.

Service for this Class A-rated machine is the standard fare for the industry—one year's parts and labor and TRW on-site service, with phone back-up.

If you look at the Core 386/33 as a pack mule with exceptional legs, you're not too far off the mark, though admittedly at a price. This machine just about has it all—well-proven components, all the speed a user could want, a standard warranty and real expansion ability. The very capable 386/33 reinforces Core's position as a heavy hitter.

FACT FILE

Core 386/33
Core International, 7171 North Federal Hwy., Boca Raton, FL 33487; (407) 997-6202.
List Price: With 4MB RAM, 64K disk cache, 1.2MB or 1.44MB floppy disk drives, one parallel and two serial ports, $7,845; with 4MB RAM, 150MB hard disk, VGA color monitor, DOS 3.3 or 4.01, $10,785.
In Short: Core's admittedly expensive 386 machine is a serious workhorse. As a file server or standalone, the 386/33 continues with Core's tradition of rugged and reliable performance.

CIRCLE 604 ON READER SERVICE CARD

CSR Inc.

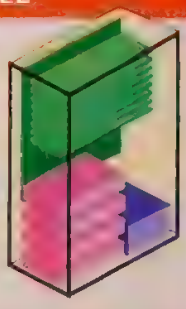
CSR 386/33

by Fredric Burke

With the CSR 386/33, flexibility is the name of the game. The machine can assume one of three different configurations—a tower, mini-tower, or desktop—but the unifying feature that all the models enjoy is the reassurance of reliable components inside, good performance and service, and a relatively low price. As a file server host or as a CAD platform, the CSR 386/33 would make an intelligent choice.

The 386/33 mini-tower we tested lists for $5,299, including 4MB RAM, an Imprimis-built CDC 150MB hard disk, a Western Digital combined hard/floppy disk controller, both Toshiba 1.2MB and 1.44MB floppy drives, a VGA monitor,

FACT FILE



CSR 386/33
CSR Inc., 200 Meadowlands Pkwy., Secaucus, NJ 07096; (800) 366-1277.
List Price: With 2MB RAM, 64K cache RAM, 1.2MB floppy disk drive, one parallel and two serial ports, $3,050; with 4MB RAM, 1.44MB floppy disk drive, 150MB hard disk, VGA color monitor, DOS 3.3 or 4.01, $5,299.
In Short: The fact that CSR chooses to sell in both the VAR and VAD markets means that this versatile and powerful machine can be had for less than list price. A highly recommended machine whose performance will not disappoint.

CIRCLE 605 ON READER SERVICE CARD

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$STD = \sqrt{\frac{\Sigma(Vi-AVG)^2}{n}}$

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CIRCLE 326 ON READER SERVICE CARD

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and DOS 4.01. Other hardware includes an Aztec 200-watt power supply and a terrifically clicky Focus Electronics keyboard.

Measuring 15- by 8.5- by 17-inches (HWD), CSR's 386/33 doesn't take up much space. The machine is nicely styled in the front, featuring an LED display, as well as other control functions and the two disk drives.

A door that covers the panel when access isn't required drew mixed reviews—it seems precariously attached and keeping it closed during extended use made the drives warmer to the touch than normal. The rest of the chassis is well-constructed and up to long-term use.

CSR's commitment to making the machine perform well is readily apparent. Internally, the Hauppauge motherboard, Chips and Technologies chipset, and the Award 3.03 BIOS—which can be shadowed in both system and video modes—reflects this, just as the number of available expansion slots does. You will find two 8-bit and six 16-bit slots, plus a proprietary 32-bit slot for an add-in memory card on the motherboard. Even when configured for the review, with video, floppy/hard drive controller and I/O (one parallel and two serial ports) installed, the

THE 386/33: TODAY'S BEST BUY

by Alfred Poor

The proliferation of CPU chips and clock speeds makes it difficult to compare the price/performance ratio of different classes of computers. A statistically precise analysis requires careful data collection, but taking a quick cut at the problem can produce approximate results that tell an interesting tale.

Here's how we came up with our estimates. We identified six classes of machines: 16-MHz 386SXs, 20-MHz 386SXs, 20-MHz 386s, 25-MHz 386s, 33-MHz 386s, and 25-MHz 486s. We then looked at the results from the most recent comprehensive reviews of those classes in *PC Magazine*. Using the results of the 386 Instruction Mix benchmark tests as our gauge, we threw out the fastest and slowest machines and took the middle ten. The average of these ten Instruction Mix test scores created a composite performance figure for the class. Finally, we computed an indexed performance value, using the 16-MHz 386SX score as the reference point. Notice that for this index, lower numbers represent shorter performance times and therefore better performance. A 25-MHz 486, for instance, is three times as fast as a 16-MHz 386SX, as shown by its index of 0.33.

We ran the same analysis using the Floating-Point Calculation Without Coprocessor and Conventional Memory tests. Since the results were essentially the same as for the Instruction Mix, we didn't include them in our chart.

NORMALIZING PRICES

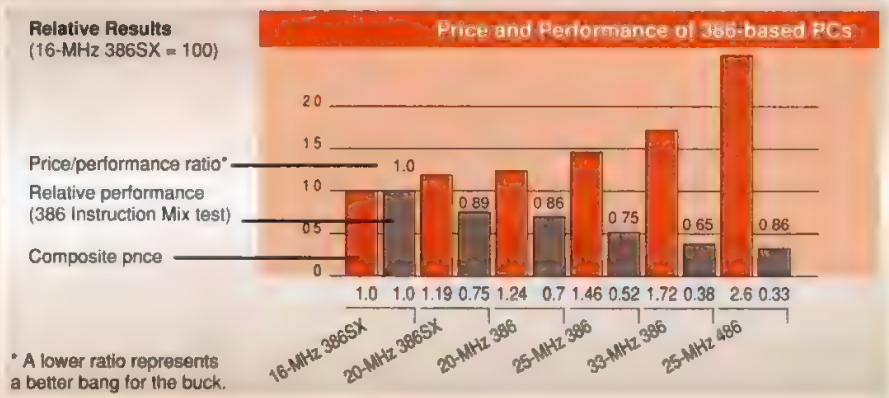
Getting prices was a tricky procedure, as we had to account for street prices and to make sure we were comparing comparably configured machines. We scanned the latest available advertisements from vendors who sell their systems by mail; this eliminated the problem of calculating street prices based on dealer discounts. We found ten vendors who offered at least five of the six models on our comparison list—including a 16-MHz 386SX—and adjusted prices to represent equivalent memory, display, and hard disk configurations. Next, we indexed the prices, using the 16-MHz 386SX price *for each product line* as our reference point. This eliminated differences in overall pricing and positioning and for different relative configurations among vendors.

Once we had index numbers for each machine, we averaged them by class, to produce a composite index price. The 16-MHz 386SX was 1.0, and numbers climbed as high as 2.6 for the 25-MHz 486 category. As with the performance index, lower numbers are better, since they represent lower prices.

We then multiplied the performance index value by the price index value for each class to create the price/performance index results. The lower this number, the better the bang for the buck. Here's an example: Assume you find a computer that has a performance value of 0.5, which means it gets a given task done in half the time that a 16-MHz 386SX would require. How much would it cost in order to equal the price/performance of the 386SX machine?

Theoretically, you should be willing to spend up to twice as much, an indexed price of 2.0, which gives the same 1.0 price/performance rating as the SX model. As you will see, the other models all offer a better price/performance value than the 16-MHz 386SX, since their ratios all come out to less than 1.0.

Remember that these figures represent composite estimates based on a relatively small sample of machines. Individual products may represent more or less attractive a value, depending on the price, the performance, and other features compared with the rest of the machines in its class. Nevertheless, based on these results, the overall conclusion is clear: As a class, the 33-MHz 386 machine gives you the most for your money in today's market. ■



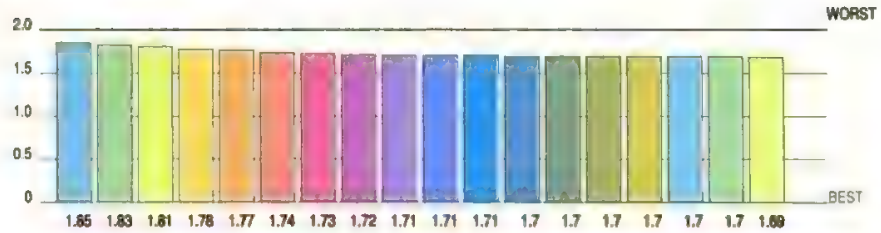
BENCHMARK TESTS: 33-MHz 386-BASED PCs

Designed around 640K of 25-nanosecond static RAM for conventional memory and a caching hard disk controller, CompuAdd's 386/33 outperforms the competition on PC Labs' benchmark tests. Overall, there is a very narrow gap between highest and lowest scores. For this reason, you should consider factors other than speed when making purchasing decisions.

PROCESSOR AND MEMORY BENCHMARK TESTS

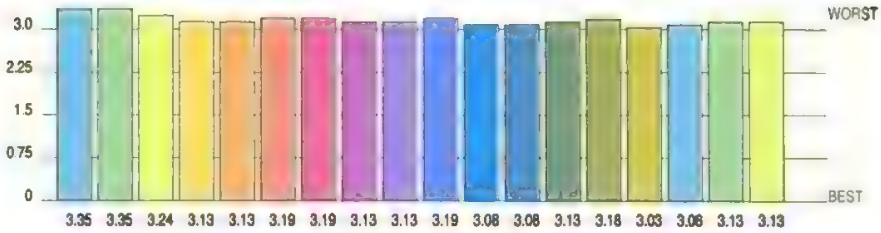
80386 Instruction Mix

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



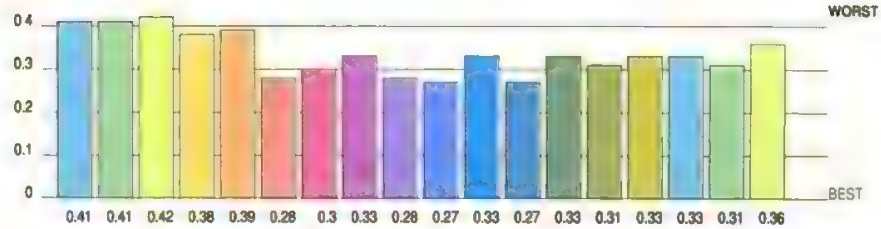
Floating-Point Calculation Without Coprocessor

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory

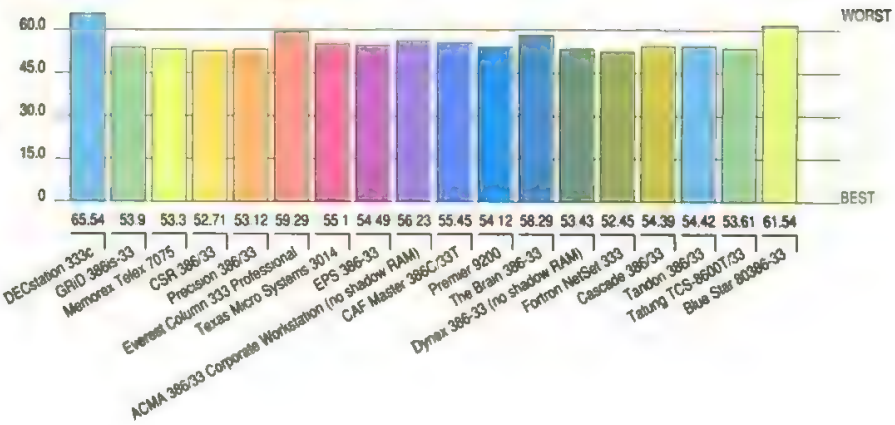
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

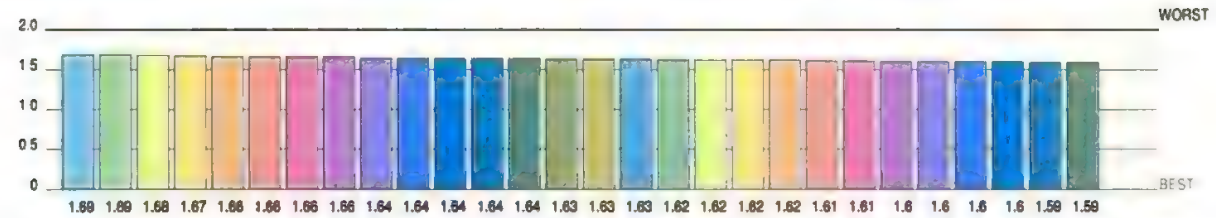
DOS File Access (Small Records)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



* Reported for comparison.

Elapsed Time (seconds)



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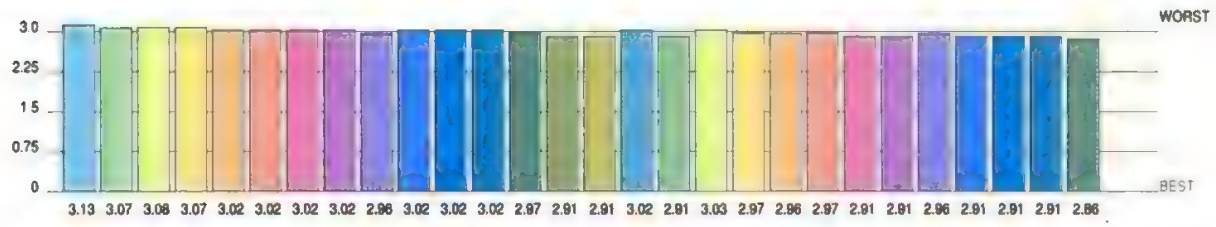

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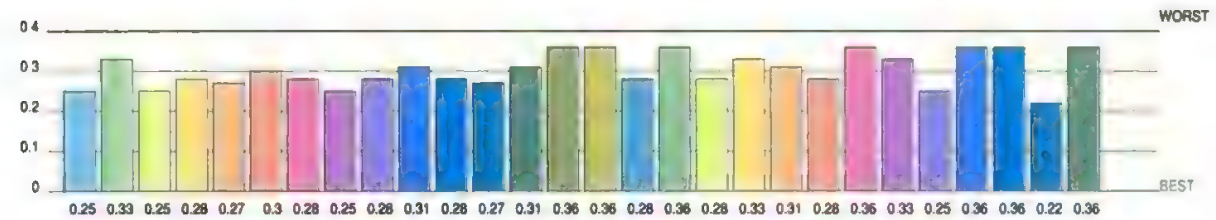

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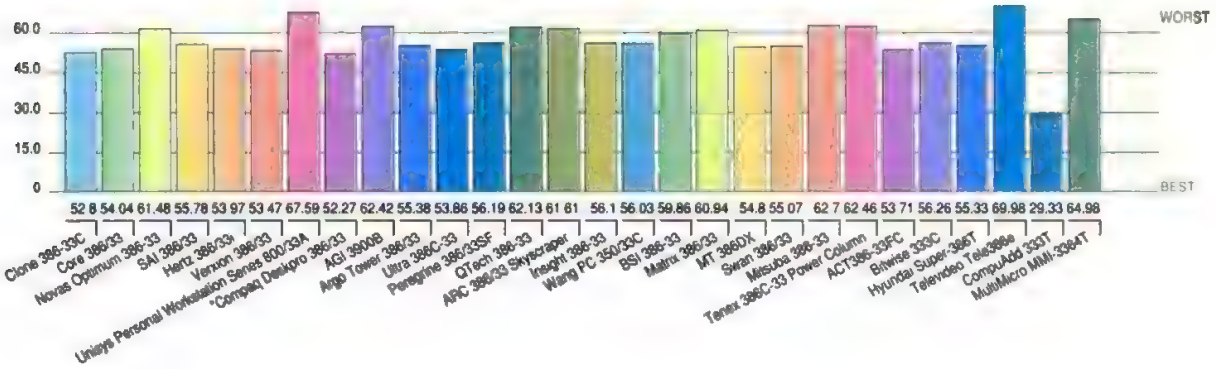

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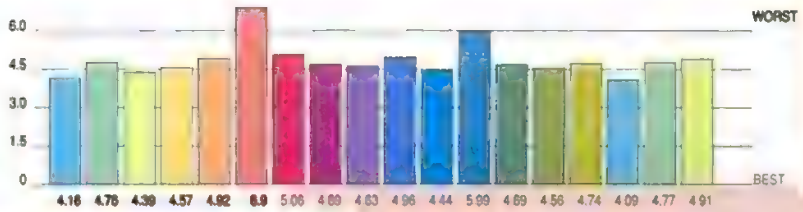
BENCHMARK TESTS: 33-MHz 386-BASED PCs

DISK BENCHMARK TESTS

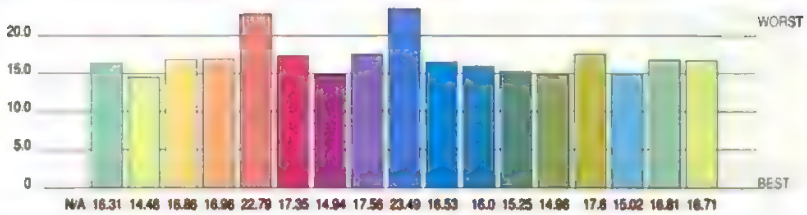
DOS File Access (Large Records)

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. Fast times are better when large files are loaded.



BIOS Disk Seek

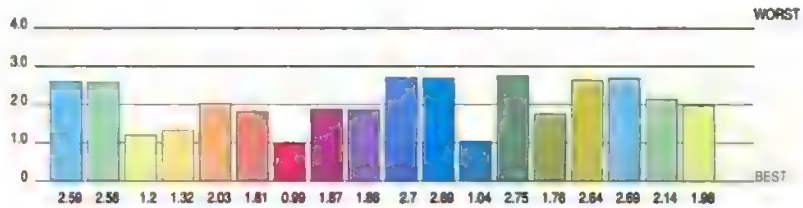
The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



VIDEO BENCHMARK TESTS

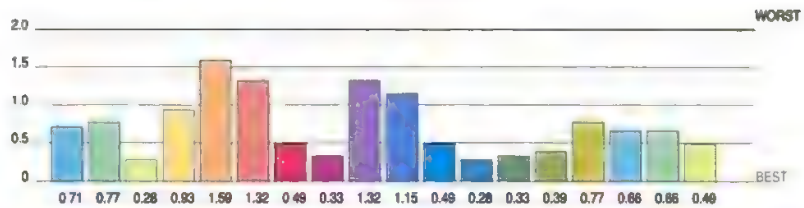
Direct to Screen

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



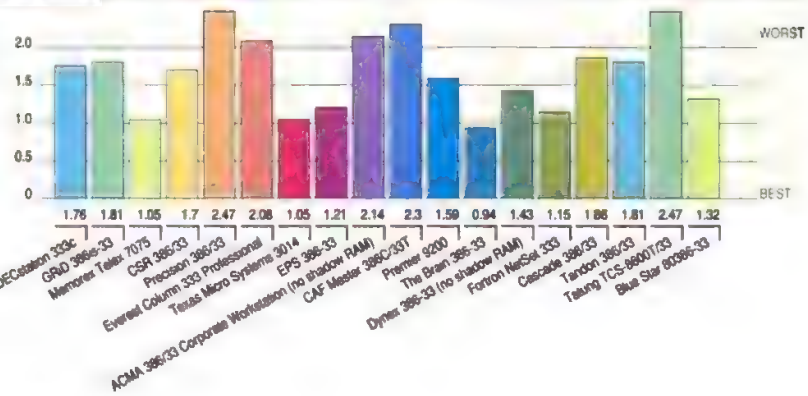
Video BIOS Routine Without Scrolling

The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



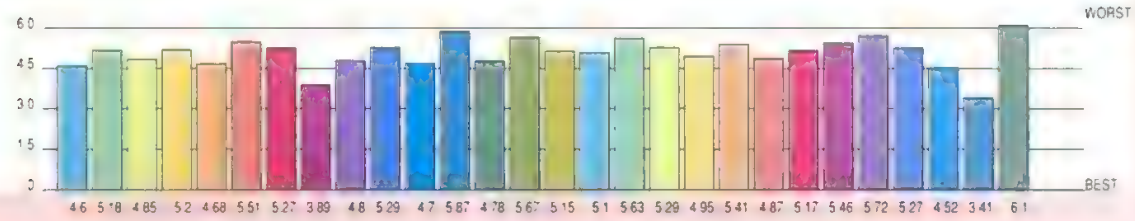
Video BIOS Routine with Scrolling

The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.

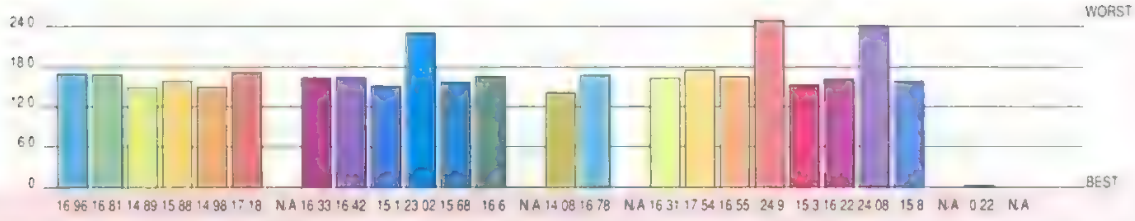


* Reported for comparison.
N/A—Not applicable: the SCSI hard disks in these systems were not compatible with PC Labs' BIOS Disk Seek test.

Elapsed Time (seconds)



Elapsed Time (milliseconds)



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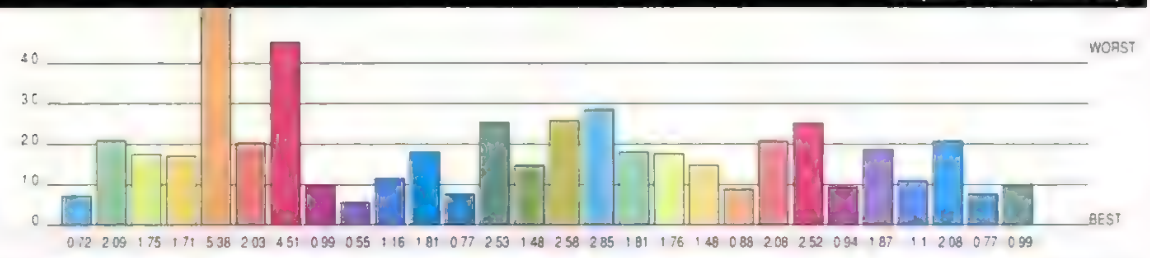

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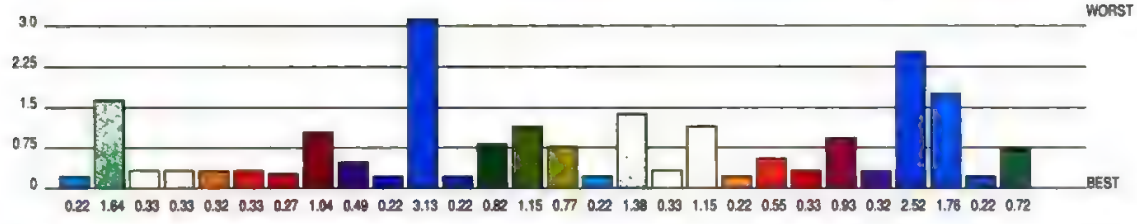

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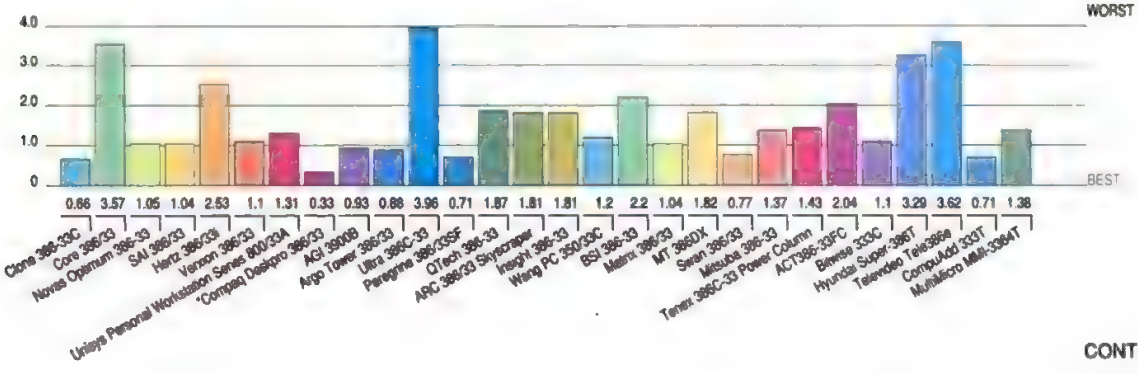

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PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

PC Labs tested 45 33-MHz 386 computers for this issue. Testing was done with video and system BIOS enabled, if possible, and buffers were left at their default value. Only CompuAdd's 333T had a caching hard disk controller with 1MB of RAM installed; we made this exception because the system was designed specifically for this device.

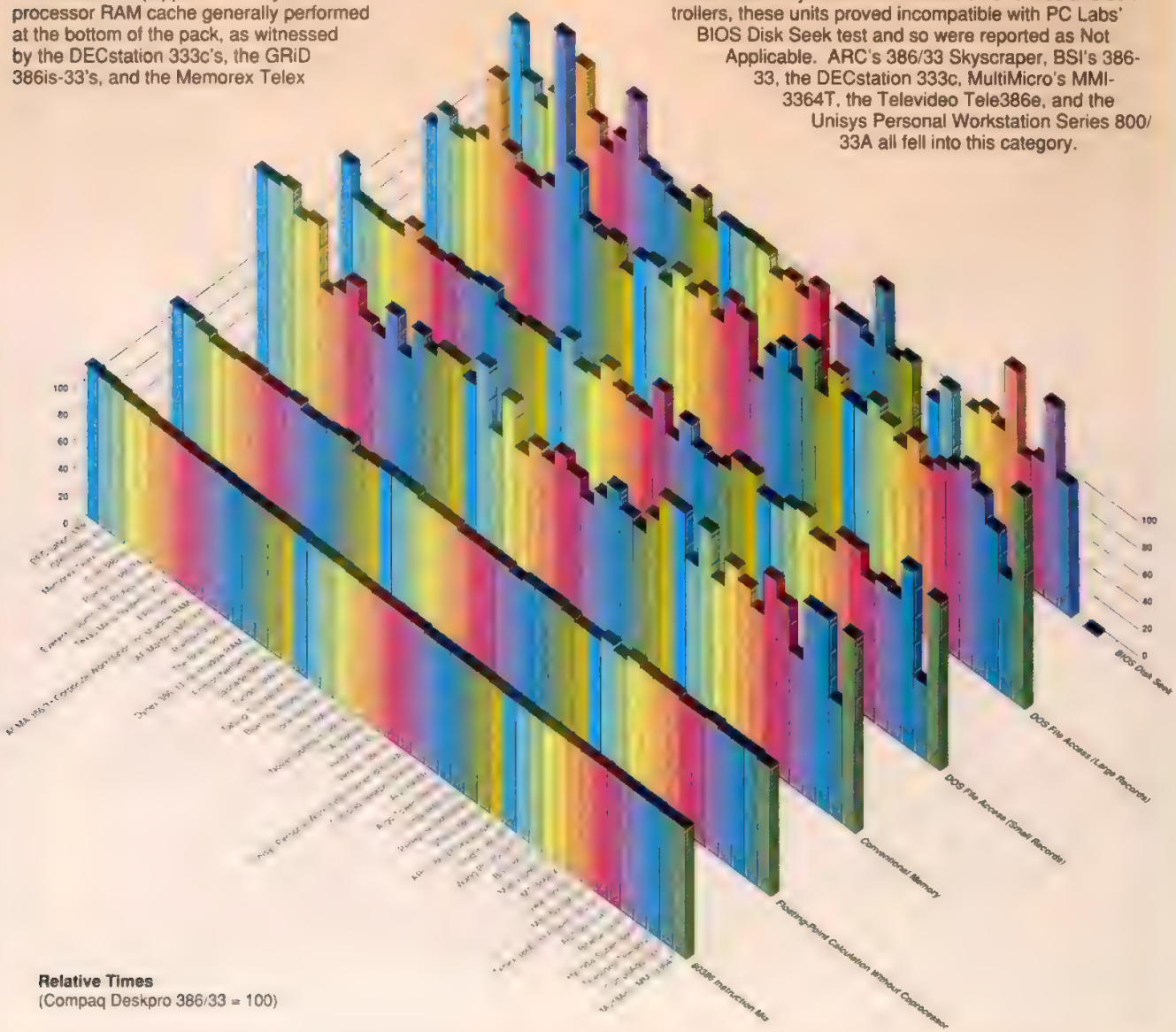
The 333T and the Bitwise 333C performed best overall on the processor and memory benchmark tests. Both used 64K of processor RAM cache to accomplish this feat, though CompuAdd used 15-nanosecond DIPs while Bitwise chose to install 25-ns. DIPs. CompuAdd also gained a slight edge by having 640K of 25-ns. static RAM installed on a card as conventional memory. This standard extra gave the system a distinct performance advantage, but it also pushed the price up, as the card itself sells for $675.

Machines equipped with only 32K of processor RAM cache generally performed at the bottom of the pack, as witnessed by the DECstation 333c's, the GRiD 386is-33's, and the Memorex Telex 7075's performance on the processor and memory benchmark test suite; these systems used Intel 82385s, as compared with CompuAdd's and Bitwise's discrete logic.

In overall disk performance, the CompuAdd system stands out, due mainly to its 1MB caching hard disk controller. The Memorex Telex 7075 is the best of the rest. Among the noncaching machines reviewed, it finished fifth on the small-record DOS File Access test, third on the large-record test, and second on the BIOS Disk Seek test. This system was equipped with a Seagate ESDI drive with Western Digital controller.

Western Digital was the controller of choice for other top performers as well. The ESDI hard disks of the top three performers on the small-record test—Clone's Imprimis, Fortron's Maxtor, and CSR's own CSR drive—were paired with the Western Digital controllers.

In the case of systems that contain SCSI drives and controllers, these units proved incompatible with PC Labs' BIOS Disk Seek test and so were reported as Not Applicable. ARC's 386/33 Skyscraper, BSI's 386-33, the DECstation 333c, MultiMicro's MMI-3364T, the Televideo Tele386e, and the Unisys Personal Workstation Series 800/33A all fell into this category.



Relative Times
(Compaq Deskpro 386/33 = 100)

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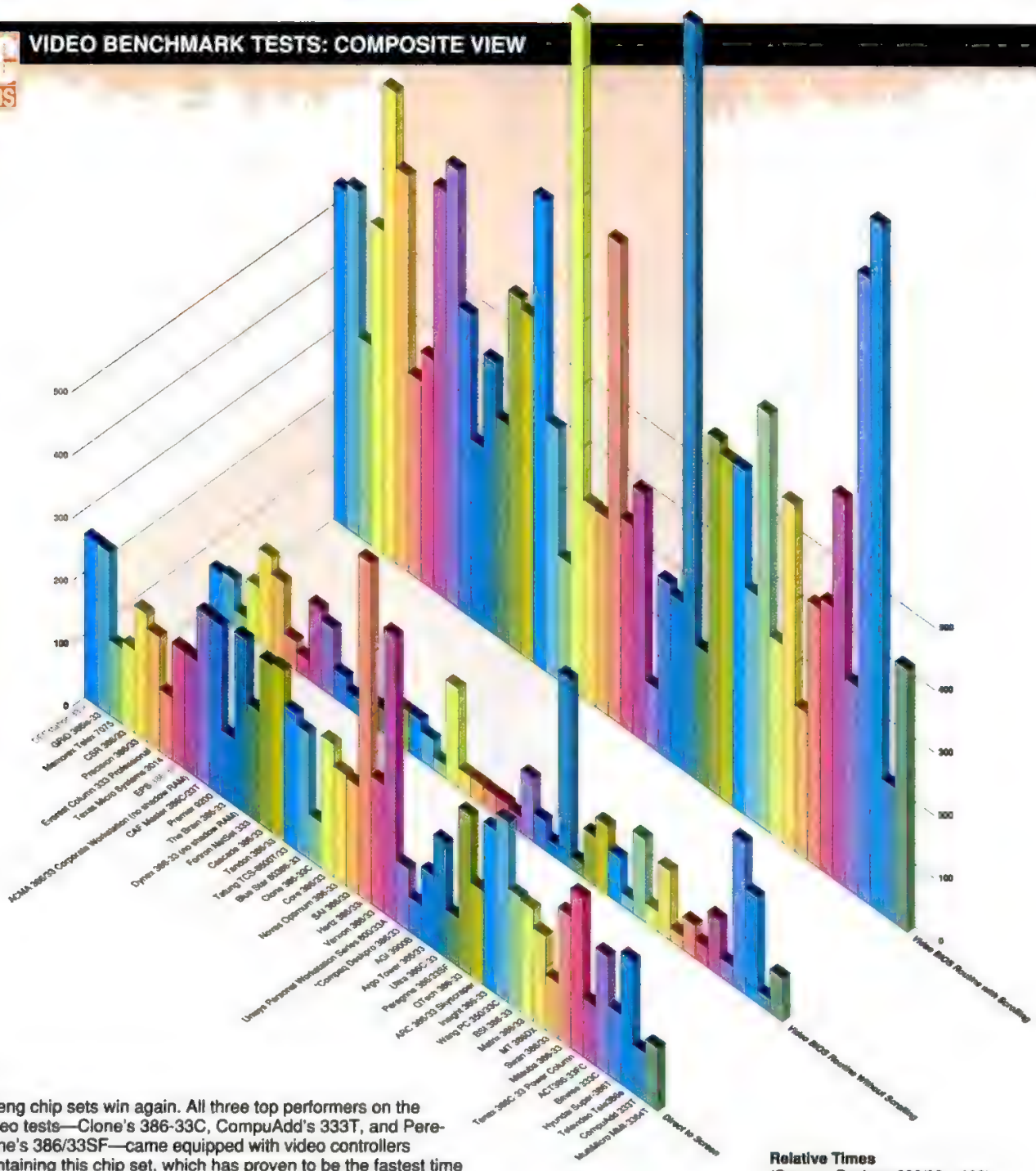
VIDEO BENCHMARK TESTS: COMPOSITE VIEW



Relative Times
(Compaq Deskpro 386/33 = 100)

Tseng chip sets win again. All three top performers on the video tests—Clone's 386-33C, CompuAdd's 333T, and Peregrine's 386/33SF—came equipped with video controllers containing this chip set, which has proven to be the fastest time after time. The Clone computer, which had the best overall score, used an STB Systems video card. Tied for second place were CompuAdd, with its CompuAdd video card, and Peregrine, with a Diamond SpeedStar VGA card.

A special mention should be made of the AGI 3900B, which, even without shadowing, managed to turn in a time of 0.55 seconds on the Direct to Screen Test. This score is far faster than even the second-place Clone. The Direct to Screen test turned out to be a stumbling block to the Hertz 386/33i, with a Trident video board and chip set, and the Unisys Personal Workstation Series 800/33A, with a Western Digital video board and chip set, both of which turned in dismal scores.

Video shadowing helped the Hertz and Unisys systems bounce back, though; both turned in excellent times on the Video BIOS Without Scrolling and average times on the Video BIOS with Scrolling test. Computer Marketplace's Ultra 386C-33 faltered when it hit the Video BIOS tests, placing it at the bottom in both tests—although it performed at an acceptable level on the Direct to Screen test. The Netis video card with a Trident chip set, along with video shadowing, did nothing to give this system an edge. Televideo's poor video BIOS test scores, meanwhile, can be attributed to the fact that the system lacks video shadowing.

ENDS

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ZEOS

CSR had five slots open, though two were eight bit—a common failing in machines of this class.

LOADS OF BUILT-IN MEMORY

The real strength of this machine, making it particularly attractive to CAD users, is the amount of memory CSR has built into it. The company starts with a non-adjustable Intel 64K cache comprised of eight 8K chips. A maximum of 4MB RAM is available on the motherboard, and an

CSR 386/33, $5,299

optional 32-bit proprietary add-in card ($253) can add another 8MB of RAM to the mix. Five optional daughterboards, at a cost of $227 each, are necessary to bring the machine up to 32MB. Each of the daughterboards holds up to 4MB; the RAM upgrade costs $235. Adding to the appeal of the CSR is the fact that it will support both an 80387 and a Weitek 3167 simultaneously.

Performance in benchmark testing placed the CSR in the top quarter of the machines in the roundup—fast access being important in any application. The CSR also did well in video testing, owing in part to the Video Seven 16-bit video card and chip set, which plugs into a NEC 2A monitor.

Since CSR sells mostly through dealers, service is done primarily through them. The warranty runs for two years on parts and one year on labor, and includes a year's on-site service from your dealer. CSR also maintains an 800 number for factory technical support.

The CSR 386/33 makes very few compromises on the way to delivering satisfaction. Its price is impressive, particularly considering its generous RAM accommodations and good performance as well as class B FCC approval. For a real price/performance value, you need look no further.

Digital Equipment Corp.

DECstation 333c

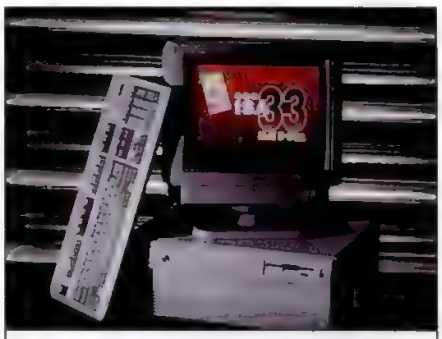
by Fredric Burke

Digital Equipment Corp. has long maintained a low-key presence in the DOS marketplace; in fact, its DECstation 333c is manufactured by Tandy. The machine lists for $6,540 in its tested configuration, including 4MB RAM, a 32K cache, a 1.44MB Sony floppy disk drive, a 170MB Imprimis SCSI hard disk rated at 19 milliseconds, a Super VGA adapter and Super VGA display, DOS 4.01, and Quarterdeck's *QEMM* memory manager. Leave out the hard disk, the video adapter, the monitor, and DOS, reduce the RAM to 1MB, and you wind up with the machine in its $4,640 basic configuration.

The Tandy tie-in offers a reasonable guarantee of both reliability and IBM compatibility. Inside the handsomely styled small desktop machine, the Tandy influence is readily apparent, as the company supplies the motherboard that contains separate Adaptec hard disk and Tandy floppy disk drive controllers. Chips and Technologies provides the 386 chip set, and Phoenix the BIOS. The BIOS cannot be shadowed in system and video modes. The motherboard supports both an 80387 and a Weitek 3167 math coprocessor, but not simultaneously.

The chassis is finished like a vault; it's as rugged and well thought-out as they come. You'll find one parallel and two serial ports, but don't look for a turbo switch—there isn't one. A mechanical lock lets you secure the case but not the keyboard. You can protect the latter through a software-supported password.

One of the inherent disadvantages of small-footprint machines is the physical limitations placed on expandability. The 6.3- by 17- by 16-inch DECstation 333c does not escape this. Two of its six 16-bit slots can be configured to accept 32-bit memory expansion cards; with a video adapter, an I/O controller, and a memory



DECstation 333c, $6,540

board installed in three slots and the drive controllers housed on the system board, our evaluation unit had three 16-bit slots remaining. Potential users will have to carefully weigh their options when it comes time to fill the remaining slots.

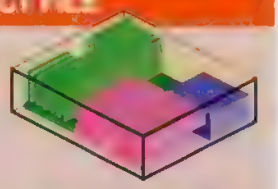
DEC equips the DECstation 333c with an Intel 82835 cache controller. Its cache, which is fixed at 32K, helped to keep the machine in the top third of those tested. The Tandy motherboard consigns system RAM to a $125 32-bit add-in card, which uses 100-ns. SIMMs and supports up to 8MB of RAM. In order to boost memory to the full 16MB usable by the system, you'll have to buy a second proprietary add-in card from DEC.

The chassis for the DEC supports up to four half-height devices. Next to the three front accessible drive bays and behind the face plate is another 3.5-inch drive bay. This expandability works well for the DEC; not many small footprint machines allow this kind of flexibility.

THE TANDY TOUCH

Tandy Corp. makes itself known again, providing the DECstation's 16-bit Super VGA card, a fairly fast adapter that uses the Paradise chip set. It's connected through a 9-pin port to a 14-inch Matsushita Super VGA monitor that's capable of a top pixel resolution of 1,024 by 768. The DECstation 333c's video performance is indicative of the rest of the

FACT FILE



DECstation 333c
Digital Equipment Corp., Porter Rd., Littleton, MA 01460; (508) 486-2183.
List Price: With 1MB RAM, 32K cache RAM, 1.44MB floppy disk drive, one parallel and two serial ports, $4,640; 4MB RAM, 170MB hard disk, VGA, DOS 4.01, $6,540.
In Short: A well-built moderately priced 33-MHz machine whose performance is well up to the standards of its class. Tandy provides many of the components, from the motherboard and floppy disk controller to the Super VGA adapter. The machine has few open expansion slots, but plenty of room for storage devices.

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- 101 Enhanced keyboard
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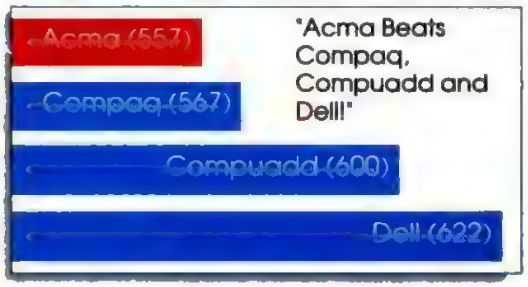

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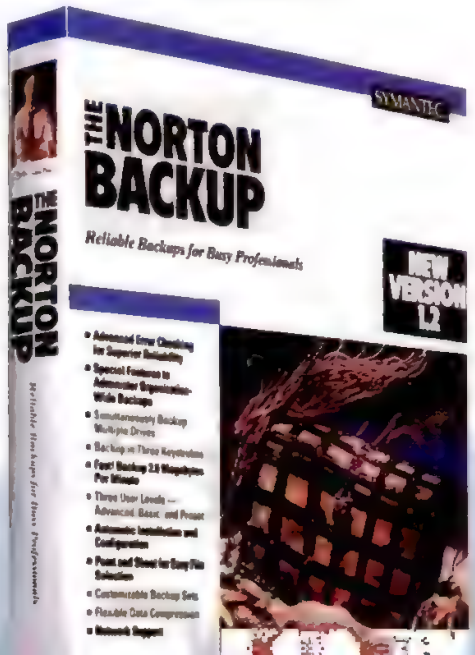
—*InfoWorld*

"If you're new to backup software or a pro who's tired of hassling with convoluted menu systems, Norton Backup is for you."
—*PC World*

"...the program that coddles you and your data better than any other... surpasses the speed of its fastest rival, Fastback Plus."
—*PC Magazine*



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machine: solid, reliable, and competent.

The respectability of the DECstation 333's components extends to both the power supply and the keyboard. Aztec provides the 200-watt power supply for the machine, and Tandy, the 101-key keyboard, a singularly pleasant typing device.

Since the machine is manufactured by Tandy, you might think that you'll be able to have it repaired at the nearest Radio Shack Computer Center. But because the DECstation differs from Tandy's machines in several respects, Tandy will not handle it. The DECstation's one-year parts-and-labor warranty is standard fare for this class of machine. If you have a defective unit or part, you'll have to either ship it back to DEC or take it to a service center for repair.

All told, the FCC Class B–certified DECstation 333c is a well-made machine that benefits by its association with two well-regarded companies: Tandy, for components that are reliable if fairly conservative in execution; and Digital, for its reputation for quality.

Dynex 386-33, $4,200

Dynamic Decisions Inc.

Dynex 386-33

by Fredric Burke

It would be difficult to find a clunker in Dynamic Decisions' line of PCs, in part because the company uses proven if unexciting technology. That combination works well for the Dynex 386-33, a machine that's equally at home as a personal workstation or as a file server, despite the lack of extensive disk and board expansion room.

The Dynex 386-33 won't leave you gasping for breath after you hear its list price. As tested, the system costs only $4,200, including 4MB RAM, a 64K cache, two TEAC floppy disk drives (1.4MB and 1.2MB), a 150MB Micropolis ESDI hard disk rated at 16 milliseconds, a Super VGA adapter and monitor, and DOS 3.3—a nice configuration for the money.

At first glance, the big Dynex system unit looks like just another AT-size clone. But inside the 5- by 21- by 17-inch case are all kinds of goodies that some more-expensive machines don't have. AMI builds the motherboard and the BIOS, and an outfit named Describe manufactures the chip set. The BIOS supports both system and video BIOS shadowing through its setup utility. The system will also support Intel 80387 and Weitek 1167 math coprocessors; an optional daughterboard allows them to run at the same time.

On the outside, you'll find that the Dynex 386-33 is also well equipped. On the front panel are reset and turbo switches as well as an LED turbo indicator and a mechanical keyboard lock.

MONDO MEMORY

Two features go a long way toward making the Dynex 386-33 an appealing machine. First is the standard, nonadjustable 64K cache, which uses fast 15-nanosecond DRAM and adds real bite to the machine's performance. Overall, the Dynex performed in the top third of the machines we tested.

Second is the Dynex's ability to accommodate up to 28MB of RAM, which should sate even the most memory-hungry applications. The motherboard will hold up to 20MB using 1MB 70-ns. DIPs—16MB more than we had in our evaluation unit. You can add another 8MB of memory with an optional ($199) 32-bit add-in board that uses 1MB DIP chips.

The Dynex offers eight slots: two 8-bit slots and six 16-bit slots, with the first 8-bit slot doubling as a 32-bit slot for the proprietary memory card. With the video adapter, I/O controller, Western Digital WDC-1007V hard and floppy disk controller, and memory board installed, our evaluation unit was left with four slots for expansion. The machine offers space for up to five half-height devices within the chassis, two of which are hidden behind the face plate.

The Dynex 386-33 did very well on PC Labs' video benchmark tests, performing in the top third of the reviewed machines; ATI's 16-bit card and chip set see to that. When coupled with the evaluation unit's 14-inch View Perfect Super VGA monitor, the result is a top resolution of 1,024 by 768. The Dynex 386-33 also features a quiet Senstron 200-watt power supply, and the company's own great 101-key keyboard.

In addition to bundling DOS 3.3 with the system, Dynamic Decisions offers *Windows* 3.0 for $99 and the Microsoft Mouse for $55. The FCC Class B-certified system comes with a one-year parts-and-labor warranty, along with the considerable benefit of having TRW provide the on-site service.

The Dynex 386-33 deserves your consideration—it may not offer the most drive or card expansion room, but its huge memory capacity and good performance, not to mention its price, make it a contender for single users or networked operations on a budget.

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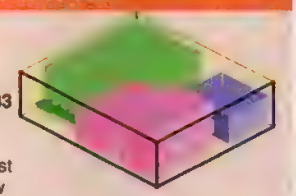

Dynex 386-33
Dynamic Decisions Inc., 134 West 26th St., New York, NY 10001; (800) 869-9888.
List Price: With 1MB RAM, controller card, 1.2MB or 1.44MB floppy disk drive, VGA Display system, $2,895; with 4MB RAM 64K disk cache, 1.2MB and 1.44MB floppy disk drive, 150MB hard drive, Super VGA monitor, one parallel and two serial ports, DOS 3.3, $4,200.
In Short: The Dynex 386-33's combination of low price and good performance make it one of the better bargains in this roundup. It can accommodate up to 28MB of RAM (20MB on the motherboard), which should satisfy even the most memory-hungry applications.

CIRCLE 607 ON READER SERVICE CARD

EPS Technologies Inc.

EPS 386-33

by Fredric Burke

That EPS Technologies has only been around for a little more than a year should not discourage potential buyers from considering its EPS 386-33. On paper and in our tests the machine gives up nothing to its competitors.

Outfitted to conform to our standard test configuration, the EPS 386-33 costs $4,020 and comes with 4MB RAM, a 64K

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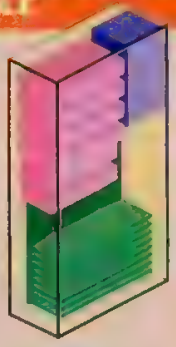

EPS 386-33
EPS Technologies Inc., 10069 Dakota St., Jefferson, SD 57038; (800) 447-0921, (800) 526-4258.
List Price: With 4MB RAM, 64K cache, 1.2MB or 1.44MB floppy disk drive, 65MB hard disk, monochrome monitor, one parallel and two serial ports, DOS 4.01, $2,799; with 1.2MB and 1.44MB floppy disk drives, 160MB hard disk, Super VGA, $4,020.
In Short: A relatively new member of the cheap-and-fast school, the fledgling EPS 386-33 offers a good combination of speed and expandability.

CIRCLE 608 ON READER SERVICE CARD

cache, a 160MB (formatted) Micropolis ESDI hard disk, an Orchid ProDesigner II Super VGA adapter and Sony Super VGA monitor, two TEAC floppy disk drives (1.2MB and 1.44MB), DOS 4.01, and Quarterdeck's *QEMM* (with *Manifest*). In its basic configuration, the machine costs $2,799 and includes 4MB RAM, a 64K cache, one 1.2MB floppy disk drive, a 65MB Mitsubishi hard disk, a Hercules adapter, and a 14-inch amber monitor. Both setups feature one parallel, one game, and two serial ports.

Inside the generously shielded and well-constructed 24- by 8- by 21-inch tower chassis, EPS's own motherboard, a Chips and Technologies chip set, and AMI BIOS provide the underpinnings for the 386-33. The BIOS supports system and video BIOS shadowing and runs the I/O bus at 8, 11, and 16.5 MHz. The motherboard can accept either an Intel 80387 or a Weitek 3167 math coprocessor.

HOME, HOME FOR THE RAM

The EPS motherboard is also home for 8MB of interleaved page-mode system RAM, which is packaged in the form of 1MB 80-nanosecond SIMMs. But the EPS 386-33 is even more generous with system memory, supporting up to 16MB with the addition of an optional $169 32-bit add-in board.

Using an Intel 82385 cache controller, the EPS 386-33 can accommodate either 32K or 64K of cache memory. Our evaluation unit was configured with 64K of 25-ns. static RAM.

Of the EPS 386-33's eight slots, three are 8-bit, one of which will serve as a 32-bit slot for a memory card, and five are 16-bit, with one of those a slot designed to accommodate either a proprietary Super EMS or memory board. With video adapter, I/O controller, memory board, and integrated Adaptec hard and floppy disk controller installed, you'll have four open slots—the bare minimum you'd want for the types of work this machine will be called on to do.

EPS offers only a few hard drive options for the 386-33, but they are useful choices that should serve the machine well. Starting with the base configuration price, add $395 for a 118MB hard disk, $795 for a 345MB device, and $2,195 for a 676MB unit. With three half-height drives installed, our evaluation unit still had three empty half-height drive bays.

The EPS 386-33's strong showing in

EPS 386-33, $4,020

the PC Labs video benchmark tests can be traced to its Orchid ProDesigner II 16-bit Super VGA video card, which uses a Tseng Labs chip set. EPS bundles Sony's Super VGA monitor with the machine, creating a reliable and powerful video package with a top pixel resolution of 1,024 by 768.

EPS looks after the less-heralded parts of its 386-33 as well, powering the machine with a quiet 220-watt Seasonic power supply. A Fujitsu 101-key keyboard makes for comfortable typing.

For a young company, EPS has managed to build an impressive service infrastructure. Free on-site service is provided by TRW as part of a one-year parts-and-labor warranty, and a toll-free number is also available for technical support. EPS claims to have FCC Class B certification by the time this article is published.

The EPS 386-33 is a machine that is bursting with promise. Its strong performance across the board on the PC Labs tests and good after-sales support are evidence that EPS is committed to the long haul. As a flagship, the 386-33 is a fine effort and should not be ignored.

Everest Computer Corp.

Everest Column 333 Professional

by Winn L. Rosch

Everest Computer Corp. is a name of convenience for the U.S. arm of Taiwan-based CMP Enterprises, which manufactures the system board and most of the other components of the Column 333 Professional. Although the company name evokes the idea of peak performance, the moniker casts only a tall shadow on the Column 333, which was the among the slower systems we tested. But even if it is not at the pinnacle of its class, the $3,480 Column 333, including (as reviewed) 4MB RAM, 64K cache RAM, a 1.2MB floppy disk drive, a 147MB IDE hard disk, a proprietary Super VGA adapter and monitor, and DOS 4.01, is still a good buy.

Nearly all of the Column 333's system board circuitry is made from discrete logic chips, which alter the function of the one Chips and Technology VSLI module on the board. One result of this design is the system's somewhat laggardly performance on PC Labs' benchmark tests.

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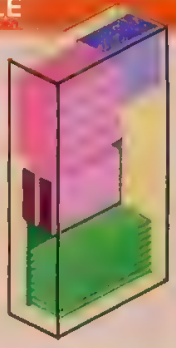

Everest Column 333 Professional
Everest Computer Corp., 1153 Tasman Dr., Sunnyvale, CA 94089; (408) 734-2604.
List Price: With 1MB RAM, 40MB hard disk, 64K cache, Hercules graphics adapter, monochrome display, desktop case, one parallel and two serial ports, $2,185; with 4MB RAM, 100MB IDE hard disk, Super VGA video adapter, Super VGA color display, tower-style case, DOS 4.01, $3,480.
In short: A slow but well-made tower-style 33-MHz 386-based PC with six half-height drive bays, six available slots, 64K cache RAM, and 16MB RAM capacity. Although indistinguishable from the multitude, it can be a good buy at its low price.

CIRCLE 609 ON READER SERVICE CARD

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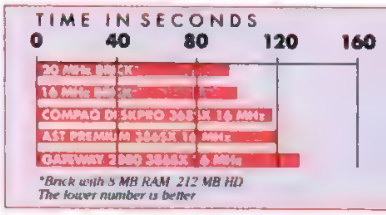

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Consistently outperforms both Compaq's and IBM's 386SX on the PC Labs computer benchmark tests...Ergo's Brick maintains the functionality of a Desktop PC within a small form factor"

— PC MAGAZINE, Sept. 1990

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aggregate of system, video and hard disk benchmarks.

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The fast VGA graphics feature up to 1024 x 768 non interlaced resolution with a full 1 MB of video memory. In fact, the Brick's video performance is twice as fast as the average of 42 386SX systems tested by *PC Magazine!* This makes an enormous difference in the perceived "response" of the system, especially if you're running graphically intensive applications like Windows or Desktop Publishing.

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CIRCLE 479 ON READER SERVICE CARD

Future versions of the PC may get a boost from a redesign, which will provide for a scalable cache of 128K, 256K, or 512K of fast, 25-nanosecond static RAM, instead of the 64K currently available.

Up to 8MB of interleaved page-mode 60-ns. SIMMs of either 256K or 1MB capacity fit on the system board. By seating an 8MB card in a proprietary 32-bit slot, you can stretch the system to its 16MB addressing limit. None of that memory is used for video or system BIOS shadowing, which the Column 333 does not support.

The system setup procedure is built into the machine's AMI BIOS and can be entered when the Column 333 Professional is booting up. You can slow the 33-MHz 80386 microprocessor to 8.25-MHz, which is also the bus speed of the system.

The Column 333 earns its name from its 25- by 7.5- by 16.5-inch (HWD) tower-

Everest Column 333 Professional, $3,480

style case, which provides ample room for expansion. Substituting a desktop case, which Everest calls a "block," cuts the system cost by $125. The overall design and workmanship of the machine are good but not remarkable. The chassis itself is brightly plated, and the few wires and cables inside are neatly bundled together. An ill-fitting handle with hand-grooving square corners retracts into the top of the case.

Accommodations for disk and tape drives include six half-height 5.25-inch bays, two of which are completely internal; for expansion boards, eight full-size slots fill the bottom third of the case. The Column 333 even provides cut-outs for four 9-pin and four 25-pin D-shell connectors on the rear panel.

After you pop off a decorative plastic rear panel from the case, you can unscrew and slide off both the right and left side panels of the Column to gain access to the screw slots on both sides of the system's top four drive bays. Some parts of the Column 333 are more difficult to reach, however. For example, if you want to install either an Intel 80387 or 33-MHz Weitek math coprocessor, you'll have to remove an internal bay to gain access to the socket.

The Column 333's front panel looks Spartan but includes the usual controls: pushbuttons for turbo mode and reset; LED indicators for power, turbo operation, and disk activity; a cylindrical keyboard-only lock; and a red power switch.

In its basic configuration, the system costs $2,185 and comes with 1MB RAM, a 64K cache, one 1.2MB or 1.44MB floppy disk drive, a Hercules adapter, a 14-inch TTL monitor, and a 40MB IDE hard disk. The Fujitsu hard disk in our evaluation unit, a $385 upgrade, actually configures to 129MB of useful storage. A Chicony CH-101B host adapter provides the IDE connection for either drive as well as the one parallel and two serial ports that are standard in the Column 333.

Our evaluation system's Super VGA output is provided by an Everest 16-bit adapter based on the Western Digital VGA chip. The Everest color display, manufactured by Taiwan-based Intra Electronics Co., is a dual fixed-frequency display (horizontal frequencies are 31.5 and 35.2 kHz) with a top resolution of 1,024 by 768. The Nan Tan keyboard is a 102-key design with a loose, clicky feel and a generous 10-foot cable.

The power to run it all comes from a 235-watt supply with four drive connectors that generates somewhat more wind noise than most. Both a 3-volt battery soldered on to the system board and a holder filled with four AA batteries attached by Velcro to its rear panel provide CMOS power for the Column 333.

The Column 333 delivers the look, feel, and performance of a budget computer. And that's exactly what this system is.

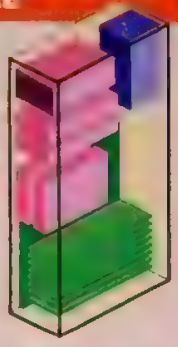
Fortron Source Corp.

Fortron NetSet 333

by Winn L. Rosch

Fortron Source's NetSet 333 will accommodate more memory than even the greediest of today's applications will demand—up to 64MB, split half on the system board and half in its single proprietary 32-bit slot. Although the NetSet 333 placed in the bottom third of the machines we reviewed, its Maxtor 160MB (151MB formatted) ESDI hard disk delivers excellent performance. That, together with its RAM capacity, makes the NetSet 333 a viable file server. At $3,945 for the tested system, which included 4MB RAM, a 64K static RAM cache, a Fortron Super VGA adapter and display, DOS 4.01, *Windows* 3.0, *PC-Kwik* disk caching software, and one floppy disk drive in addition to the hard disk ($2,250 in its basic configuration sans hard disk, video adapter, and monitor), Fortron Source's entry is less expensive than dedicated servers from network vendors and will likely suffer neither disgrace nor distinction in comparison.

FACT FILE



Fortron NetSet 333
Fortron Source Corp., 6818-G Patterson Pass Rd., Livermore, CA 94550; (800) 821-9771.
List Price: With 4MB RAM, 64K cache RAM, one parallel, one game, and two serial ports, DOS 4.01, $2,250; with Super VGA adapter, Super VGA monitor, 150MB hard disk, $3,945.
In Short: A top-heavy tower with a 33-MHz 386 processor, 64K cache RAM, and the ability to handle up to 64MB RAM (32MB on system board, 32MB in proprietary expansion slot), but otherwise not a distinguished performer. A system to buy when RAM needs are extreme.

CIRCLE 610 ON READER SERVICE CARD

With only twin 3.5-inch and half-height 5.25-inch drive bays, the towering 24- by 6.5- by 17.8-inch (HWD) NetSet 333 has little more than adequate drive capacity. At the top of the chassis is space for a full-height hard disk. Although this design uses space efficiently, it also makes the tower somewhat top-heavy. Thus, you'll want to make sure that the NetSet 333 stands firmly on its four flipper-like feet.

Fortron's full AT-size system board, which is based on a Chips and Technology chip set and discrete logic, houses the machine's vast array of memory in an assortment of 36 DIP and four SIMM sockets. Both 1MB and 4MB DIP chips will fit, as will 256K, 1MB, and 4MB

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Advanced Micro Devices

CIRCLE 197 ON READER SERVICE CARD

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Fortron NetSet 333, $3,945

SIMMs, for a total of 32MB on the system board. Of the system's eight slots, the bottom-most accommodates either an ordinary 8-bit expansion board or a proprietary 32-bit board with up to another 32MB of 70-ns. interleaved page-mode RAM.

The NetSet 333 uses a 64K cache of very fast 15-ns. static-RAM but to little avail. Its performance on the PC Labs benchmark tests was about 6 percent slower than that of the leader. The size of the cache is fixed.

A socket for either an Intel 80387 or Weitek 3167 coprocessor is readily accessible just above the expansion slots. Setup procedures are built into the AMI BIOS, including facilities for disabling the system and video BIOS shadowing.

To show off its two-speed operation—33 MHz or 8 MHz—the NetSet 333 has a large 6.25-inch LED speed display with a molded rectangular turbo switch nearby. Unfortunately, the switch proved only intermittently functional, rarely changing the speed of the system.

Fortron has chosen its disk subsystem well. The NetSet 333's 16.5-ms. Maxtor hard disk performed particularly well on the PC Labs DOS File Access test, no doubt in part because of its Western Digital WD1007V-SE2 ESDI combined hard/floppy disk controller, which occupies a 16-bit slot. Two other 16-bit slots in our evaluation unit held a proprietary I/O board, which yields two serial, one parallel, and one game port, and a proprietary Super VGA controller.

The design and construction of the NetSet 333's chassis are good but not exemplary. The unplated, unpainted steel fabrications are sturdy, but some edges are sharp enough that you might cut yourself if you're not careful. All wiring is tie-wrapped into place, and the system board is generally accessible. To add drives you will have to remove entire drive bays to access hidden screw holes—an intricate maneuver.

The Fortron 220-watt power supply offers four power connectors, three of which were already used in our evaluation unit. A Tadrian 6.8-volt lithium battery powers the CMOS and clock. Besides the four-inch fan in the power supply, a second fan located near the bottom of the front panel and just above the NetSet's tiny, two-inch loudspeaker helps to cool the system unit.

The 101-key Fortron keyboard has a quiet touch and rubbery over-center tactile feedback. The Fortron Super VGA monitor is actually a Tatung in disguise. Its 13-inch screen delivers a bright, sharp image at a pixel resolution of up to 1,024 by 768 (but at a slow 35.5 kHz horizontal frequency). To cope with various video standards, the monitor has extra horizontal phase and width controls below the front edge of its bezel and vertical size and position controls on its rear panel.

Backed by a one-year parts-and-labor warranty that includes on-site service by GE Computer Services, the NetSet 333 is a workable but not remarkable computer. Although it has no major weaknesses, it lacks the strength to elbow its way out of the crowd.

GRiD Systems Corp.

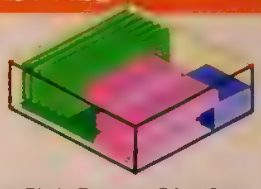
GRiD 386is-33

by Winn L. Rosch

According to GRiD Systems Corp., its engineers designed the GRiD 386is-33 for manufacture by its parent company, Tandy. If so, GRiD's design effort might have begun and ended with a look at a Tandy 386-based PC in a Radio Shack catalog, since the resemblance between the machines stops only at their name tags.

While the GRiD 386is-33 offers some enhancements over its all-Tandy inspiration—a great keyboard and an almost-unlimited variety of drive options—it is very much a Tandy computer. That means good quality at a relatively steep price. The $5,999 base system includes 4MB RAM, a 1.44MB floppy disk drive, and a VGA adapter. Add an Imprimis 150MB ESDI hard disk ($1,800), a Tandy VGM-200 VGA monitor ($500), and DOS 4.01 ($150) to extend the 386is-33 to the standard *PC Magazine* test configuration, and the list price rockets up to $8,449. (For other monitor options, check with your local Radio Shack store, which should sell the same monitors that are marketed by GRiD for the 386is-33.)

FACT FILE



GRiD 386is-33
GRiD Systems Corp.,
47211 Lakeview Blvd., Fremont, CA 94538; (800) 222-4743.
List Price: With 4MB RAM, 1.44MB floppy disk drive, 32K cache RAM, one serial, one parallel port, VGA adapter, $5,999; with VGA monitor, 150MB hard disk, DOS 4.01, $8,449.
In Short: An expansive, small-footprint 33-MHz 386 with relatively modest performance but good integration and workmanship. With space for four drive bays and four full-length and two half-length slots, consider it an adequate, but not remarkable, desktop workstation.

CIRCLE 611 ON READER SERVICE CARD

A small-footprint design, the GRiD 386is-33 measures a trim 6.5 by 17 by 15 inches (HWD) by shaving off a couple of expansion slots and a drive bay. It offers two side-by-side 3.5-inch bays and two stacked half-height 5.25-inch bays that will also accommodate a full-height device. Proprietary plastic mounting rails for both 5.25-inch bays are already installed.

The seven retaining brackets on the rear panel of the GRiD 386is-33 belie the system's real expansion capacity. Because it uses a backplane design, three expansion slots are filled with the basic necessities of computing.

A microprocessor-and-cache card resides in a proprietary slot, and two outboard slots do double-duty for memory and options. Each of the two has a proprietary 32-bit connector for system RAM boards (one of which was filled in our review system). The remaining four slots accommodate full-length, full-height 16-bit ISA expansion boards. In our evaluation system, one of them was filled with an Adaptec ESDI hard disk controller card although an IDE connector is provided on the system board. Thus, systems that use IDE drives will have one more full-length slot free than we did.

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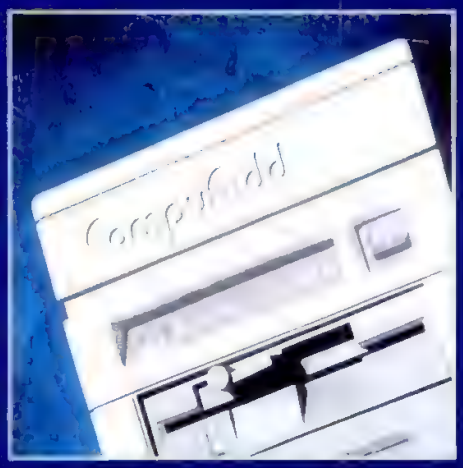

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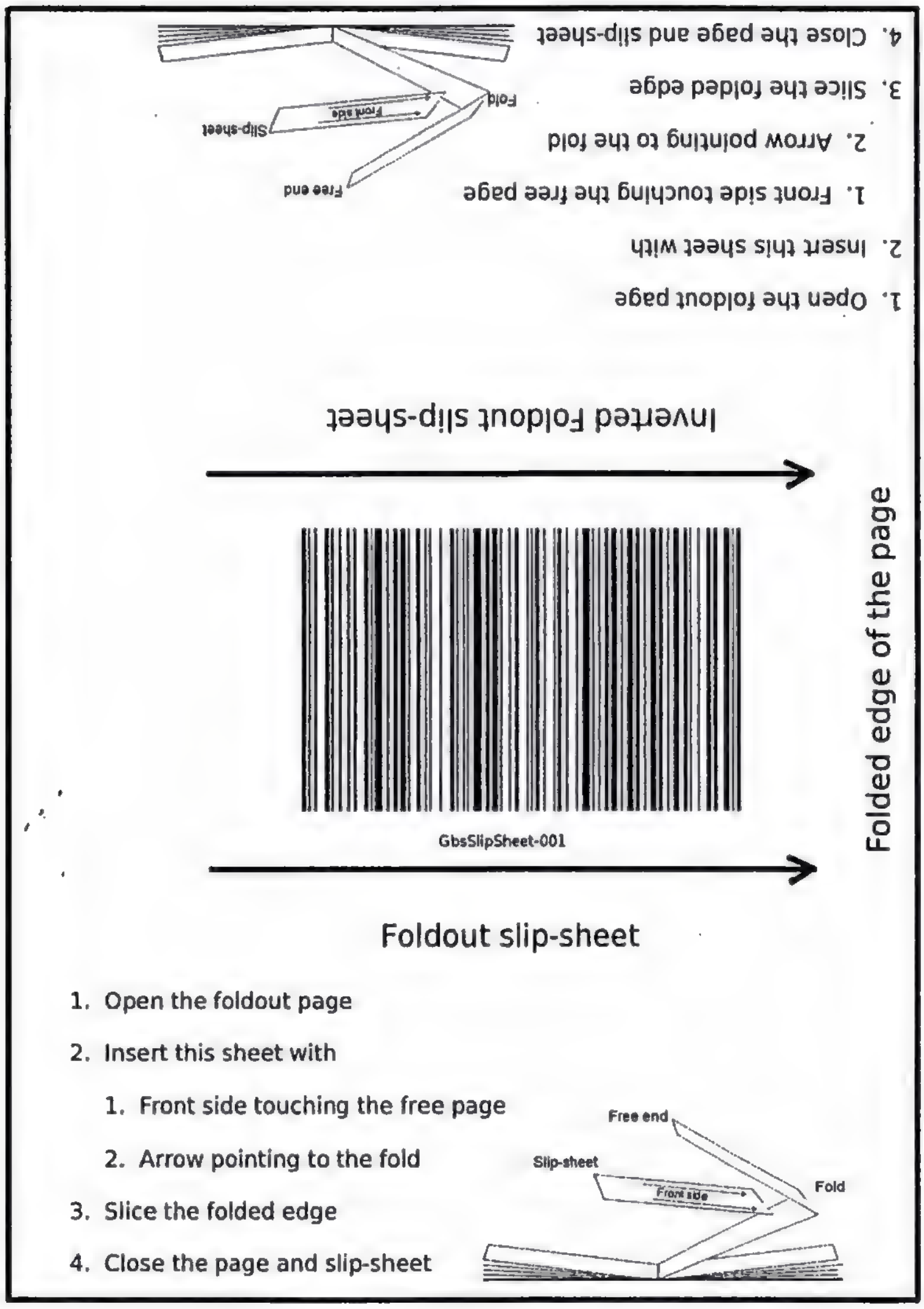
Inverted Foldout slip-sheet
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2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet
Free end
Slip-sheet
Front side
Fold
Folded edge of the page
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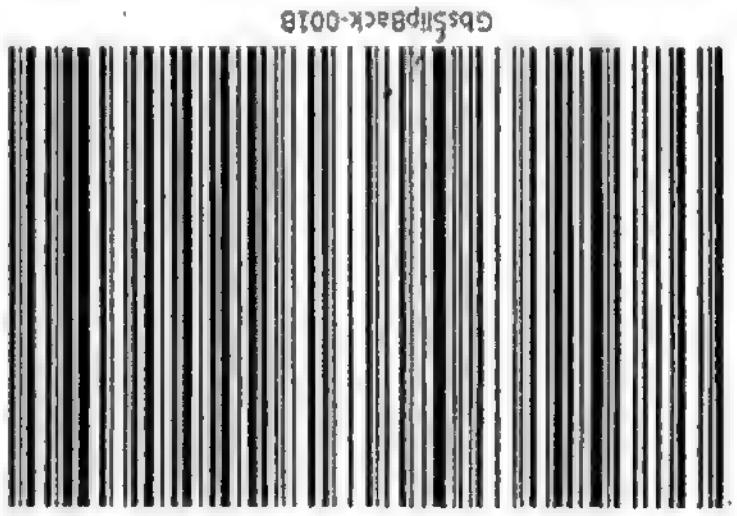
Fold



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1. Follow instructions on the other side

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GRiD 386is-33, $8,449

With memory installed, each short slot can hold an AT expansion board up to 7.25 inches long. One of these in our review system was filled with a Tandy VGA-16 display adapter. Each six-inch memory board has eight SIMM sockets, giving the GRiD 386is-33 machine a total capacity of 16MB of 80-ns. page-mode memory that's interleaved in even increments of 8MB.

The microprocessor board is home for the system's 33-MHz 80386 microprocessor, a socket for an optional 80387 coprocessor, and an Intel 82385 cache controller. Sixteen sockets hold the 32K of nonexpandable 20-ns. cache memory. Even with the cache, the 386is-33 scored near the bottom of the machines in its class.

The backplane of the GRiD 386is-33 is active. That is, the Tandy system board provides all the support functions to operate the computer except for memory and microprocessor. Included in its circuitry are the floppy disk drive controller, which is capable of handling two disk drives; serial, parallel, and PS/2-style mouse ports (one each); clock and CMOS; and the IDE connector. The backplane fills nearly the entire bottom of the computer, cut away only under the drive bays.

Controls on the front of the GRiD 386is-33 case are minimal. The on/off switch at the upper right edge of the front panel connects to the 200-watt Tandy power supply at the right rear corner of the chassis with a long plastic rod. At the left on the front panel is a reset switch and a mechanical lock for the case. Password protection for the keyboard is provided as part of the Phoenix BIOS.

The system unit itself is sturdily made with steel that's thick for the size of the chassis. Interior wiring is kept to a minimum and is well-controlled.

Screening has been added in a couple of places to cut emissions down to the FCC Class B level. Although the ESDI cable looks odd in that it squeezes between some of this screen and the top of the microprocessor board, this scheme is the only way to achieve a good interference-reducing connection between the top of the case and the bottom.

The GRiD 101-key keyboard deserves special note for its precise action and exacting tactile and gentle audible feedback.

There's little wrong with the GRiD 386is-33 other than its price. But since the 386is-33 is sold only by the GRiD direct sales force and through VARs, you stand a good chance of negotiating a more reasonable price.

Hertz Computer Corp.

Hertz 386/33i

by Winn L. Rosch

Saying that Hertz Computer Corp.'s 386/33i is built like a tank is more truth than simile. This file server extrordinaire is reinforced with layers of heavy armor plating and has more expansion options than most people might normally need.

For $5,095, you can buy the Hertz 386/33i in its basic configuration, which includes 4MB RAM, a 64K processor RAM cache, either a 1.2MB or 1.44MB floppy disk drive, either DOS 3.3 or 4.01, and a controller but no hard disk, video adapter, or monitor. Add a second floppy disk drive, a Micropolis 160MB ESDI hard disk, a Trident VGA adapter, and a Sony CPD-1304 monitor, all of which came with our evaluation system, and the price jumps to $7,595, making the package expensive but competitive with major-brand PCs and ones of equal quality.

Hertz 386/33i, $7,595

This 24.5- by 6.8- by 26.5-inch (HWD) tower system is, in fact, made by a major brand: Intel Corp. Hertz was Intel's first OEM vendor for the company's 386-based system boards in 1986, and the 386/33i continues that tradition.

Intel builds—or perhaps overbuilds—sturdy computers. The armor on the 386/33i is double-thick. After you remove the heavy steel decorative case sheath, you still must pry off additional sheet metal covering the drive bays and expansion slots to get at the system's innards. Underneath is plenty of room for expansion, including four half-height 5.25-inch drive bays, two full-height bays, and ten (yes, ten) expansion slots.

The slots themselves are vertical; expansion boards hang down from them like sleeping bats. Two slots use Intel's 32-bit expansion bus and seven the standard 16-bit ISA bus; the last is an 8-bit slot designed for an expansion board with a drooping skirt. In all working models, two of the 16-bit slots are filled—one with a Trident VGA adapter and the other an Ultrastor Ultra 12(F) combined ESDI hard/floppy disk controller.

Additional sheet metal is used to form a cooling channel over the 386/33i's memory: eight SIMM sockets for 1MB modules (although 256K modules will work, Hertz doesn't offer them), and eight 4-by-64K, 25-ns. SRAM chips that serve as a cache.

The Intel motherboard does not use an

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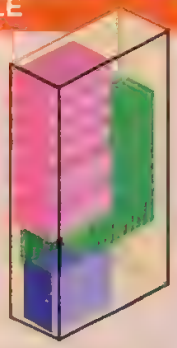

Hertz 386/33i
Hertz Computer Corp., 325 Fifth Ave., New York, NY 10016; (800) 232-8737, (212) 684-4141.
List Price: With 4MB RAM, 1.2MB or 1.44MB floppy disk drive, one parallel, one mouse, and two serial ports, DOS 3.3 or 4.01, $5,095; with 1.2MB and 1.44MB floppy disk drives, 160MB ESDI hard disk, Super VGA adapter, multiscan monitor, $7,595.
In Short: A sturdy, almost armor-plated tower computer with ten expansion slots, four half-height, and two full-height drive bays manufactured by Intel. Its minicomputer-like construction and the excellent performance delivered by its 64K proprietary cache make the 386/33i a top choice for a file server or a workstation where cost is no object.

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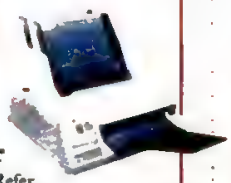

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Intel 82385 cache controller but instead opts for a proprietary design, which is said to offer better performance. Even so, the Hertz 386/33i scored only in the middle of the spectrum of machines reviewed here.

You'll have to remove the wind-tunnel cover to access the 33-MHz 80386 microprocessor and coprocessor socket, which will accommodate either an 80387 or Weitek 3167 operating at 33-MHz. The Phoenix BIOS includes setup procedures in its code, and supports system and video BIOS shadowing.

A large six-inch fan blows air through the cooling channel and out of the rear bottom of the chassis. A 302-watt power supply is tucked in the bottom front corner of the chassis. Although the power supply has only four DC connectors, the chassis has a strip of additional power connectors into which you can plug cables. Battery power is packaged along with CMOS memory and the system clock in a Dallas module.

The power cord and output jack for monitor power are situated at the very bottom of the back of the case, the best possible location. Expansion board connections run through a tunnel at the top of the case, hidden by a pivoting plastic trap door, and out an opening in the rear.

The front control panel offers a minimum of controls—a keyboard lock, reset switch, and two indicators for power and drive activity. The power switch is at foot level in front of the chassis. Although there's no turbo switch, you can slow the 386/33i down to 8-MHz by pressing a three-key combination on the keyboard.

The Hertz 101-key keyboard uses Cherry switch mechanisms. It's a lightweight product with a gentle snap action. However, keys must be fully released before they will snap a second time.

The Class B-certified 386/33i is protected by a one-year warranty that provides for on-site service anywhere in the world by Intel. But the well-armored Hertz 386/33i is unlikely to need that, even in a network war zone.

Hyundai Electronics America

Hyundai Super-386T

by Winn L. Rosch

Anyone who is familiar with the Korean industry giant Hyundai would expect a computer bearing that label to use exclusively imported components. Not the Super-386T. This compact powerhouse bears a Made-in-USA label and uses American parts, from its system board to its hard disk drive. That was a good decision: the Super-386T came in second in overall performance on PC Labs' benchmark tests.

The Super-386T also bears an American sticker price rather than that of a budget import. With 4MB RAM, a 64K processor RAM cache, a 200MB IDE hard disk, one 1.2MB floppy disk drive, and a Super VGA video display, the system costs $7,840; with 4MB RAM, a 64K processor RAM cache, a 40MB hard disk, one 1.2MB floppy disk drive, a VGA adapter but no monitor, the system costs $5,595.

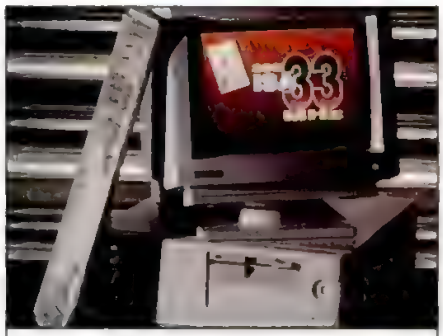
As stylish as it is speedy, the Super-386T comes in a 6.3- by 16- by 16.5-inch (HWD) case with smoothly rounded edges on its front panel. Everything you need—on/off, reset, turbo, and keyboard-lock switches as well as colorful LED indicators for power, disk activity, and turbo operation—is up front where it counts. The chassis is as sturdy as it is attractive. The unpainted heavy-weight stamped steel doesn't give in the least even when leaned upon heavily.

The small-footprint case allows for about all the expansion a desktop computer might need. The unit has two 5.25-inch horizontal half-height drive bays with front-panel access and two vertical 3.5-inch bays, one with front-panel access and the other hidden deeply inside.

Seven expansion slots line the left side of the case: one 8-bit, one 32-bit, and the rest 16-bit ISAs. Two of the 16-bit slots are filled in any working system, one with an ATI VGA Wonder display adapter, the other with a Silicon Valley Computers combined IDE host adapter and floppy disk controller.

The Super-386T's motherboard itself is manufactured by the Motherboard Factory. It uses an AMI BIOS, with its setup function built into the BIOS. Most of the circuitry is made from discrete chips, with only one large ASIC from VLSI Corp. The three standard ports—two serial (both with 9-pin connectors) and one parallel—all originate in system board circuitry.

The heart of the system board is, of course, a 33-MHz Intel 80386 microprocessor. A socket awaits the addition of an Intel 80387 or Weitek 3167 coprocessor, either of which must be rated at 33-MHz. Eight sockets are provided for page-mode SIMMs with either 256K or 1MB capacity and an 80-ns. speed rating. Complementing the computer's main memory is 64K of 20-ns. SRAM cache control, which uses discrete circuitry. Neither system nor video BIOS shadowing is supported.



Hyundai Super-386T, $7,254

Those who want to add a numeric coprocessor themselves will have an easy time, because the socket is easily accessed once the system is open. Adding memory is a different story. The SIMM sockets are hidden under the power supply, which you must remove (or remove the system board) in order to get at them.

The Super-386T's hard disk, a Conner 200MB 3.5-inch unit, sits in an internal bay next to the power supply. Its formatted capacity is 203MB. Although you must remove both 3.5-inch bays to add (or subtract) a drive unit, the operation is easy, involving the removal of only two screws.

The Hyundai's 200-watt power supply is electrically linked to the on/off switch on the front panel. The switch is enclosed

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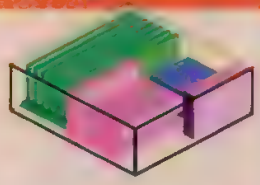

Hyundai Super-386T
Hyundai Electronics America, 166 Baypointe Pkwy., San Jose, CA 94134; (408) 473-9200.
List Price: With 4MB RAM, 40MB hard disk, 1.2MB floppy disk drive, one parallel and two serial ports, VGA adapter, mouse, DOS 4.01, $5,595; with 200MB hard disk, VGA display, $7,254.
In Short: An attractive small-footprint 33-MHz 386-based PC with big performance thanks to its 64K cache. It includes eight expansion slots and two half-height 5.25-inch and two 3.5-inch drive bays.

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in a metal box, which keeps it safe when the system unit is opened.

Although the disk drive ribbon cables are snarled in the case, the rest of the internal layout is very clean, and power supply wires are neatly bundled. Four power connectors for drives are provided, two of which are used.

Hyundai supplies an Oki Japan 101-key keyboard, which has a quiet click and good tactile feedback. Also standard with the FCC Class B-rated Super-386T is an 18-month parts-and-labor warranty. You'll have to return the system to your dealer if it needs service.

As the Super-386T proves, Hyundai isn't only a manufacturer of budget-priced imports. Its name should also be associated with a quality American-made computer—albeit one that doesn't cost all that much less than a subcompact car.

Insight Distribution Network Inc.

Insight 386-33

by Winn L. Rosch

Aiming high, Insight Distribution Network Inc. targets systems from leading mail-order vendors as the competition it hopes its new Insight 386-33 will crush. The machine has the potential. It's got the power, is backed by good service, and has an appealing list price. But its design and overall quality fall short of the mark.

The Insight system that comes closest to the others reviewed in this roundup includes a 200MB Conner hard disk, one 1.2MB or one 1.44MB floppy disk drive, a Super VGA adapter and display, a 64K processor RAM cache, either DOS 3.3 or 4.01, and 4MB of RAM, and costs $3,695. (Recently, Insight upped the standard memory of the 386-33 to 8MB, which raises the system cost by $200.) The least expensive system, with a 40MB IDE hard disk, one floppy disk drive, 64K processor RAM cache, and Hercules video system, costs $2,739 with 8MB RAM.

Instead of using custom-designed cases and system boards like its direct-mail rivals, Insight has assembled its system from generic components and backed their workmanship with a one-year parts-and-labor warranty. The centerpiece of the Insight 386-33 is its Armas motherboard, which is based primarily on a Chips and Technologies chip set and an AMI BIOS. The 33-MHz 80386 can be augmented by either an Intel 80387 or Weitek 3167 math coprocessor operating at 25 MHz or 33 MHz. On PC Labs' benchmark tests the board's 64K cache and interleaved page memory earned the Insight 386-33 a performance score in the upper third of the machines we tested and within a fraction of the leaders. Both video and system BIOS shadowing are supported.

Perhaps the most notable detail of the Armas motherboard is its memory accommodations: 12 SIMM sockets and 36 DIP sockets. In the standard 8MB configuration, eight of the SIMM sockets are filled with 80-ns. 1MB modules; the remaining sockets and the DIPs (armed with 1Mb chips) can extend the Insight's memory to 16MB. The Armas motherboard makes no provision for high-speed add-in memory boards.

Of the eight ISA slots housed in the Insight's tower-style case, two are used by standard equipment: a Chicony host adapter for IDE hard disks, which also supplies the system's one parallel and two serial ports; and an ATI VGA Wonder, which offers video output to match any standard from Hercules to Super VGA. These two 16-bit boards leave four 16- and two 8-bit slots free for future expansion. The bus operates at either 8 MHz or 16 MHz.

The big Insight case, which measures 24 by 7.5 by 19 (HWD) inches, doesn't provide much room for drive expansion. In our evaluation system, the two 3.5-inch bays contained a TEAC floppy disk drive and a 200MB Conner hard disk, which formats to 204MB. One of the two half-height 5.25-inch bays housed a Toshiba floppy disk drive. Only an internal full-height and a half-height 5.25-inch bay were vacant. The five connectors of the 250-watt KPI power supply are exactly what's needed to accommodate additional drives.

Insight 386-33, $3,695

Inside, the Insight 386-33 is neat though not a paragon of design elegance. Outside, however, the system is attractive, with its turbo and reset buttons molded into the control panel. A two-digit LED display indicates whether the Insight is operating at 33 MHz or its slower 8 MHz rate. The front panel keyswitch locks the keyboard but does not prevent access to the inside of the case.

Insight provides adequate peripherals for the 386-33, among them a Chicony soft-click 101-key keyboard with 12 top-row function keys and a TVM Supersync 3A Super VGA monitor. The one-year of on-site service through TRW should allay whatever fears you might have about the system or these accessories.

Price is the prime reason for choosing the Insight. Although its drive accommodations and 16MB maximum memory may prove limited in the future, the 386-33 will likely provide a lot of assistance until then.

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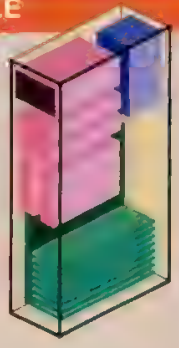

Insight 386-33
Insight Distribution Network Inc., 1912 West Fourth St., Tempe, AZ 85281; (800) 776-7600.
List Price: With 4MB RAM, 40MB hard disk, 1.2MB or 1.44MB floppy disk drive, VGA adapter, Super VGA display, DOS 3.3 or 4.01, $2,739; with 200MB hard disk, $3,695.
In Short: A powerful 33-MHz 386-based tower with 64K cache that aims to be a price leader. Although the case has more than adequate expansion room—eight slots and two half-height, one full-height 5.25-inch bays and two 3.5-inch bays—integration is not as good as that of the direct-market leaders. A good buy when price is the overriding object.

CIRCLE 614 ON READER SERVICE CARD

Master Computer Inc.

Cascade 386/33

by Mitt Jones

Master Computer's Cascade 386/33 comes in a so-so, mini-tower chassis, runs at respectable speeds, and sells at a lower-to-middle-range price. Overall, however,

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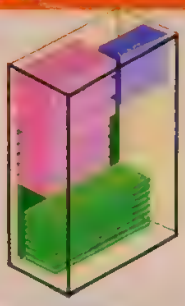

Cascade 386/33
Master Computer Inc., 10742 5th Ave. NE, Seattle, WA 98125; (206) 365-1156
List Price: With 4MB RAM, 64K processor RAM cache, 1.2MB and 1.44MB floppy disk drives, one parallel, one game, and two serial ports, DOS 3.3 or 4.01, $2,795; with 150MB hard disk, Super VGA monitor, $4,495.
In Short: The Cascade 386/33 employs name-brand components and performs competently but fails to distinguish itself from the competition.

CIRCLE 615 ON READER SERVICE CARD

the Cascade 386/33 stops short of distinguishing itself—either for its vices or virtues.

Prices for the Cascade 386/33 start at $2,795, which buys you 4MB RAM, a 64K static RAM cache, one 1.2MB 5.25-inch and one 1.44MB 3.5-inch floppy disk drive, and DOS 3.3 or 4.01. Our evaluation unit came with a 150MB hard disk and color Super VGA display, bringing the list price to $4,495.

The machine's respectable collection of name-brand components begins with a Micronics motherboard. Unlike the Micronics board used in several other of the machines reviewed here, this version utilizes discrete logic instead of a single chip set. The board employs Phoenix BIOS and provides two 8-bit slots, five 16-bit slots, and one proprietary, 32-bit slot.

One of the few recognizable chips on the motherboard is the Intel 82385 cache controller, which accommodates either 32K or 64K of static RAM and allows either direct map or two-way set associative operation. Our unit came fully configured with 64K of 25-nanosecond static RAM and was set to operate with the two-way set-associate cache.

The motherboard relegates all system RAM to one proprietary, 32-bit board, populated to half its capacity in our unit with 4MB of 9-by-1MB, 80-ns. SIMMs. Two 40-pin connectors allow installation of an optional daughtercard, which brings the total 32-bit memory capacity to 16MB.

Other motherboard features include a single 121-pin PGA socket, which accommodates either an Intel 80387 or Weitek 3167 math coprocessor. The motherboard supports both system and video BIOS shadowing and can run the I/O bus at 8.25 MHz or 11 MHz.

The hard disk in our evaluation unit was the NEC LR 56913, a 16-millisecond ESDI drive with a formatted capacity of 157MB. A Western Digital WD1007-SE2 controller with an 8K buffer played host to the hard disk and Chinon floppy disk drives.

The Super VGA video subsystem comprised a 16-bit ATI VGA Wonder with 512K RAM and an analog-only GoldStar 1460 Plus monitor. As a team, the two are capable of a top resolution of 800-by-600 with 16 colors. The adapter can drive an 8514/A or high-resolution multiscanning monitor at a resolution of 1,024-by-768 interlaced with four colors.

Master Computer ships the Cascade 386 with a 101-key Key Tronic keyboard. The Key Tronic feels notably solid and substantial, but buyers who like a little click in their key action are in a for a bit of a disappointment.

The mini-tower chassis, which measures 18.6 by 6.8 by 15.8 (HWD) inches, boasts a few nice features but suffers from a notable drawback or two. The niceties include plenty of back-panel port cutouts, a thin but effective tower stand, and a full assortment of front-panel features: reset and turbo buttons, keyboard lock, a two-digit LED turbo indicator, and front-panel access to three half-height drives and two micro-height, 3.5-inch drives. The drive carriage makes room for three additional micro-height 3.5-inch drives behind the front panel.

The bad news comes to light the first time you need to poke around inside the machine. The chassis frame seems sturdy enough, if somewhat roughly finished, but putting the cover and coated-plastic front panel back on can test one's patience and upper-body strength—the fit is a bit too snug. When we had managed at last to reassemble the Cascade 386/33, we noticed that the front-panel power button had receded from its cut-out at some point during the operation.

Cascade 386/33, $4,495

Master Computer has made at least some attempt to provide real documentation with this machine, but the resulting 34-page manual is exceptional only in its poor use of language, lack of illustrations, and dearth of useful information. Neither novice nor power user will glean much from these pages. Fortunately, Master also provides vendors' manuals for major components, including the Micronics motherboard.

The Cascade 386/33 comes with a one-year, parts-and-labor warranty. Master reports that it sells its machines both through dealers and via mail order. Mail-order buyers can receive service via phone with 24-hour parts shipping or by shipping the machine back to Master. Those who buy from a dealer must return the machine to the dealer for service.

Master Computer's 33-MHz entry performs competently, offers a nice selection of features, and comes with well-known, capable components. Overall, however, Master provides no compelling reason for buyers to opt for the Cascade 386/33. Other machines reviewed in this roundup offer comparable features, quality, and performance at a lower price.

Matrix Digital Products Inc.

Matrix 386/33

by Mitt Jones

The Matrix 386/33 lacks any semblance of custom documentation, carries only FCC Class A certification, and sells at a price a good bit above that of some of its more-aggressive competitors. For those in the market for a low-cost network file server, however, this machine begins to look like a bargain, thanks in large part to its roomy tower chassis.

In its basic configuration, the Matrix 386/33 lists at $2,435 and comes with 4MB RAM, a 32K processor RAM cache, one 1.2MB 5.25-inch floppy disk drive, a 14-inch monographics monitor, *QAPlus* diagnostics, and DOS 3.3 or 4.01. Our evaluation unit, which came with a 64K cache, 159MB hard disk, color Super VGA display, and *Disk Manager* 4.0, carried a

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The charts shown use figures included in a 1990 study conducted by Diagnostic Research, Inc., among Fortune 1000 MIS managers familiar with Macintosh and MS DOS or Windows systems. Call and we'll send you
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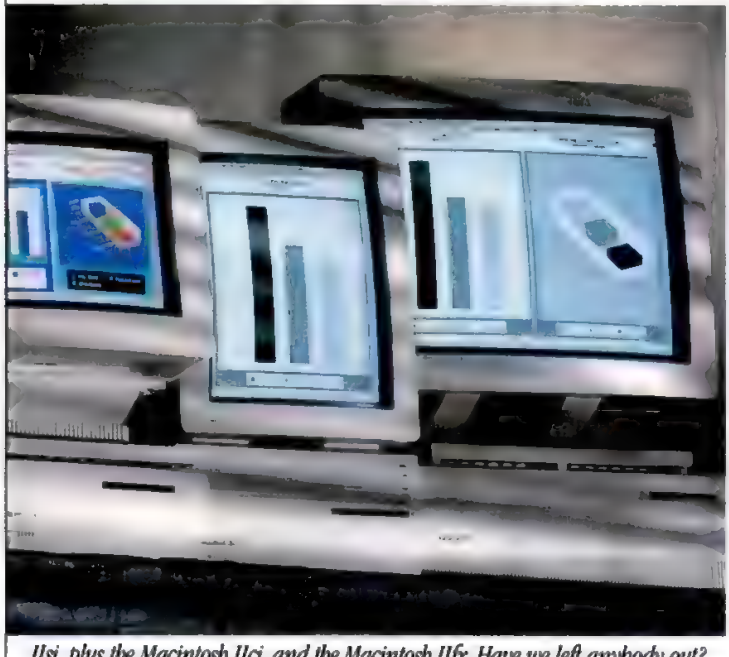

IIsi, plus the Macintosh IIci, and the Macintosh IIfx. Have we left anybody out?

The Macintosh LC.

The new, low-cost Macintosh LC introduces exquisite Macintosh color and graphics to a wider world. With its 16 MHz 68020 processor, it runs all the thousands of Macintosh programs at impressive speed. And, with an optional Apple® IIe Card, it runs thousands more Apple II applications as well. The Macintosh LC expands by adding a card to its standard slot. A 40MB internal hard drive is standard.

A built-in video chip runs either an Apple monochrome or low-cost color monitor—without adding a video card. And the Macintosh LC, like the Mac IIsi, even lets you record your voice and other sounds into the computer. Which will soon make voice-annotated software a standard Macintosh feature.

The Macintosh IIsi.

Running a 20 MHz 68030 microprocessor, the Macintosh IIsi delivers serious number-crunching at the most attractive possible price.

Into its sleek package are compressed all the powerful essentials of the Mac II line. Including an optional 32-bit NuBus™ slot supporting high-performance graphics and accelerator cards. Along with advanced networking systems like Ethernet and Token-Ring. Plus a 40 or 80MB hard drive. Built-in video chips drive four different Apple monitors.

This is a family show.

In 1984, we offered only one Macintosh. As of today, you can choose from seven different models.

Although they include some of the most powerful personal computers ever made, they all run with the same point-and-click simplicity. The way a computer system should work, of course.

But Macintosh is still the only one in the world that works this way.

It doesn't cost anything to ask.

With one call, we'll get you to someone who will show you our most affordable new computers.

Just dial 800-538-9696, extension 350.

Now that everybody can afford a Macintosh, come in and find out why you're going to want one.

The power to be your best.

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list price of $4,880. All configurations include one parallel, one game, and two serial ports.

Though lacking the reassuring heft and internal finish you'd generally get with a more expensive machine, the tower chassis of the Matrix 386/33 fits together well and seems solidly built. The chassis, which measures 23.8 by 7 by 19.1 (HWD) inches, provides room for a respectable number of storage devices. Our evaluation unit came with a full-height, 159MB ESDI drive—a Seagate ST 4182E—tucked into one of two hidden, full-height bays. The chassis provides front-panel access to an additional four drive bays—two standard-height, 3.5-inch bays and two half-height, 5.25-inch. Other chassis features include a two-digit system speed indicator on the front panel and two pairs of pivoting feet on the bottom panel, which swing out to provide additional stability.

The Micronics motherboard mounted at the lower end of the chassis deserves special mention. You probably won't look at the board often, but you'll feel good about the machine when you do. Micronics built the board around its own four-chip chip set, which lies in a grid arrangement next to the 33-MHz 386 chip and Intel 82385 cache controller. The static-RAM chips line up in two columns to the right, near the 121-pin math coprocessor socket and Phoenix BIOS chips, and four SIMM connectors line up to the left. An ugly motherboard might work just as well, but this clean, integrated design should make system upgrades and maintenance somewhat quicker and easier.

Our evaluation unit came fully endowed with eight 25-ns., 8-by-8K chips, providing the 64K static RAM necessary to allow two-way associative cache operation. With only 32K installed, the motherboard must be configured to run with a direct-mapped cache.

Our unit also provided not only the maximum of 4MB of 80-nanosecond motherboard SIMMs but also an unpopulated 32-bit memory card. The card, which occupies the board's one 32-bit expansion slot, will accommodate a maximum of 16MB RAM via four banks of four SIMM connectors. Lest you conclude that 4MB plus 16MB equals 20MB, however, beware: either the motherboard SIMM connectors or bank 0 on the memory card must be left vacant, which results in a total 32-bit system RAM capacity of 16MB.

The 121-pin PGA socket accommodates either an Intel 80387 or Weitek 3167 math coprocessor, and the motherboard supports both BIOS and video shadowing. Bus speed can be set through hardware at 8.25 MHz, 11 MHz, or 16.5 MHz.

Micronics dispensed with the traditional 8-bit slot or two when designing this motherboard, providing instead seven 16-bit slots in addition to the high-speed memory slot. Three of the seven in our unit were occupied, one by the 8-bit I/O controller, another by the Data Technology Corp. (DTC) ESDI disk controller, and the third by a 16-bit Super VGA adapter.

The I/O controller provides a parallel port and 9-pin video port via its slot bracket. Two additional ports, a game port and 25-pin serial port, extend via cable to the chassis' back-panel port cutouts.

The DTC 6280-15T disk controller, which accepts a maximum track buffer of 32K, came with an 8K buffer and played host to the 1.2MB Epson floppy drive and 16.5-ms. Seagate ESDI hard drive.

The 16-bit video controller, fully loaded with 512K RAM, bears no identification but uses the Paradise/Western Digital chip set and is an OEM version of a Paradise board. As a team, the Paradise board and our machine's 14-inch monitor—a Relisys RE5155 TTL/analog multiscanning monitor—are capable of a maximum resolution of 800 by 600 with 16 simultaneous colors.

Matrix Digital 's warranty covers parts and labor for the Matrix 386/33 for one year through its dealers. The company reports that it will begin providing four months of free on-site service through Nationwide Warranty Corp. in January of 1991. System documentation is limited to the DOS manuals and vendors' component manuals.

The Matrix 386/33 performed respectably on all of the PC Labs benchmark tests, but its hard disk performance fell toward the slow end of the pack. If you buy this machine, you'll probably want to upgrade the disk controller to its full 32K RAM track buffer.

All in all, the Matrix 386/33 is nothing to rave over, but it does offer respectable performance, relatively solid construction, and name-brand components. If you're looking for a low-cost network file server and are willing to forgo documentation and Class B certification, this machine might be worth a closer look.

Matrix 386/33, $4,880

FACT FILE

Matrix 386/33
Matrix Digital Products Inc., 1811 North Keystone St., Burbank, CA 91504; (800) 227-5723, (818) 566-8567.
List Price: With 4MB RAM, 32K cache RAM, 1.2MB floppy disk drive, monographics monitor, one parallel, one game, and two serial ports, DOS 3.3 or 4.01, *QAPlus* diagnostics, $2,435; with 64K cache RAM, 159MB hard disk, Super VGA display, $4,880.
In Short: With its spacious tower chassis and capable, name-brand components, the Matrix 386/33 is a viable choice for low-cost network file-server applications if documentation is not a priority.

CIRCLE 616 ON READER SERVICE CARD

Memorex Telex Corp.

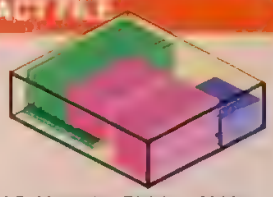
Memorex Telex 7075

by Mitt Jones

Long a seller of 3270 terminals and AS/400 peripherals, Memorex Telex has expanded its line of offerings to include intelligent workstations—a.k.a. PCs. In this case, the intelligent workstation, the Memorex Telex 7075, is a repackaged and slightly altered AST Premium 386/33 (see "22 Powerhouse PCs Top Off at 33 MHz," October 31, 1989).

In keeping with its major-league corporate image, Memorex Telex lists the 7075 at prices most of us would rather not pay. The base system is configured with 4MB RAM, a 32K processor RAM cache,

FACT FILE



Memorex Telex 7075
Memorex
Telex Corp., U.S. Marketing Division, 6929 North Lakewood Ave., Tulsa, OK 74117-1800; (800) 950-3465.
List Price: With 4MB RAM, 32K cache RAM, 1.44MB floppy disk drive, one parallel and two serial ports, utilities, $7,300; with 160MB hard disk, Super VGA monitor, DOS 4.01, $11,619; with 80387 math coprocessor, $13,219.
In Short: The Memorex Telex 7075, a repackaged AST Premium 386/33, combines high-end quality and flexibility with the backing of a company well-versed in 3270 and AS/400 environments.

CIRCLE 617 ON READER SERVICE CARD

and one 1.44MB 3.5-inch floppy disk drive, and carries a list price of $7,300. Additionally equipped with a 160MB ESDI hard drive, a Super VGA display, and DOS 4.01 to meet our standard configuration for this article, the system costs $11,619. Our evaluation unit also came with a 33-MHz 80387 math coprocessor, which brings things up to $13,219.

Of course, as with IBM, Compaq, and other companies that go the high-list-price route, Memorex Telex might be willing to lower the selling price somewhat. A Memorex Telex representative declined to say that the company offers discounts but did say that selling prices were competitive. In addition, the company stresses its strong customer support service and total-solution, direct-sales approach.

Aside from differences in chassis color and markings, the Memorex Telex 7075 looks identical to the AST machine, and the FCC Class B certification statement on the back panel of the system even bears the AST Premium 386/33 name. This should in no way be construed as a complaint. The desktop chassis is an excellent one, well-built, well-fitted, and offering abundant features, including a flush-mounted front-panel reset button and front-panel access to three half-height drives. Two additional half-height drives lie hidden behind the front panel. The back panel includes a chassis lock and cutouts for the standard-equipment parallel port and two serial ports, which derive from the system board.

Internally, the 7075 uses the same AST system and processor boards as the Premium 386/33. The system board provides one 8-bit slot, three 16-bit slots, and three 32-bit slots. The processor board installs into one of the 32-bit slots and provides the 386 processor, sockets for both the Intel 80387 and Weitek 3167 math coprocessors, 4MB of 80-nanosecond memory, an Intel 82385 cache controller, and 32K of 25-ns. cache memory. The Award-based AST BIOS supports video and system BIOS shadowing and offers three types of password protection. It also provides an extensive CMOS setup program, which allows a great deal of flexibility in specifying system operation and includes a few options that can be tailored to network applications.

In what has to be one of this machine's most unusual features, the two additional 32-bit slots can each accommodate an extra 16MB of high-speed RAM via AST add-in cards, which will provide users with an upper limit of 36MB of high-speed, 32-bit RAM.

Of the seven system board slots, one of the 16-bit slots and two of the 32-bit slots use AST's SMARTslot extensions. In theory, the SMARTslot bus was to allow AST machines to make use of bus-mastering adapters, but the adapters never materialized, in part because AST joined the rest of the "gang of nine" in creating and endorsing the EISA 32-bit bus architecture. While the SMARTslot extensions, which are simply remnants of pre-EISA days, won't do anything for you, they won't get in the way, either.

Memorex Telex 7075, $11,619

In one of its departures from the AST machines *PC Magazine* has reviewed in the past, the 7075 uses a 16-bit Headland Technology Super VGA adapter and Tatung VGA monitor rather than AST video components. The hard disk subsystem in our evaluation unit comprised a Western Digital WD1007V-SE2 ESDI controller and Seagate/Imprimis 94246 hard disk, which is rated at 16-ms. and formats to a capacity of 160MB. Instead of using the floppy controller integrated into the motherboard, the 7075 connects its TEAC floppy disk drive to the floppy interface integrated into the Western Digital controller.

The 7075's keyboard, manufactured by NMB Electronics, rates no less than wonderful. This large, 101-style keyboard feels substantial and provides a clicky key action every IBM keyboard fan should appreciate.

Memorex Telex ships the 7075 with AST's excellent 150-page user's manual, albeit relabelled with the Memorex Telex name. Memorex Telex gives buyers two free options for the standard warranty: the company will cover parts and labor for one year under a carry-in arrangement or for 90 days with on-site service. For the paltry sum of $35, you can upgrade service to one full year of on-site service. With any of these arrangements, service is performed by the company's national network of 240 service centers.

The 7075 performed about as fast as its AST counterpart on the PC Labs processor and memory benchmark tests, but, like the AST, rates among the slowest 33-MHz machines you'll find in these types of tasks. This disappointing speed can probably be attributed to the machine's use of the Intel cache controller in its direct-map mode and the straight row/column system memory arrangement. The 7075 turned in respectable results on disk and video tests, however, and actually showed some better speeds than the AST Premium system that was reviewed previously.

Despite its mediocre performance and substantial list price, the 7075 should be an attractive machine for a number of buyers, and particularly for those working in 3270 and AS/400 environments. If you need the support and service a company like Memorex Telex can provide and want a solid, well-built machine, the Memorex Telex 7075 may be the perfect computer for you.

Micro Telesis Inc.
MT 386DX

by Mitt Jones

Micro Telesis Inc. sells its 33-MHz MT 386DX at about the price you'd expect to pay for a comparably equipped 386SX

To earn the Okidata OK™, we had to re-invent the laser printer.

And the price: $999.

At $999, the Okidata OL400 is the lowest-priced page printer on the market today.* What's more, that price includes features you won't find on the LaserJet® IIP, even though it lists for hundreds of dollars more.

The 4 ppm OL400 emulates HP® Series II for compatibility with most popular software, and comes complete with more standard type faces and more resident fonts, plus a high-capacity paper tray that's optional on the HP—all in a slim, lower-profile design that's less bulky sitting on your desktop.

The Laserless Printhead: Warranteed For 5 Years.

The OL400 also comes with the longest warranty in the industry: 5 years on the printhead, plus 1 year parts and labor on the entire printer. To deliver a warranty that strong, our engineers had to re-invent the laser printer.

To replace the conventional page-printer technology of laser beams, lenses and rotating mirrors, they designed a proprietary, solid-state LED printhead with no moving parts.

It's All In Our Head.

Besides being inherently reliable, the simpler design of the Okidata printhead also means a straight-line paper path that's less likely to jam—even when feeding envelopes, heavy stock, or labels. And, since we build it ourselves, the cost stays low.

The Okidata OK–A Badge Of Honor.

The performance and features of the OL400 were good enough to earn it a PC Magazine Editors' Choice Award. But it also had to earn something else—the Okidata OK!

What's the Okidata OK? Simply our promise that every printer we make will deliver not merely acceptable performance, but outstanding performance—not just good value, but exceptional value.

So if you're looking for a good choice in an affordable personal page printer, don't stop looking until you've found the *best* choice—the Okidata OL400.

For further information about the full line of Okidata page printers, call 1-800-800-7333.

OKI OK!

OKIDATA® OK!™

We don't just design it to work. We design it to work wonders.™

*Manufacturers suggested retail price. Dealer prices may vary. OKIDATA is a registered trademark of Oki America, Inc., Marque déposée de Oki America Inc. HP and LaserJet are registered trademarks of the Hewlett Packard Corporation.

CIRCLE 235 ON READER SERVICE CARD

machine, and an inexpensive one at that. In its base configuration, the MT 386DX costs $2,399, including 2MB RAM, 64K processor RAM cache, two floppy drives, a 40MB hard disk, a VGA display, and either DOS 3.3 or 4.01. Loaded with 4MB RAM, 64K of processor RAM cache, a 150MB ESDI hard disk, two floppy drives, a Super VGA display, and DOS 3.3, our evaluation unit carried the incredibly low list price of $2,899. Whether or not you should give in to the temptation of this pricing will depend primarily on how much irritation you're willing to put up with, and how much of a risk you're willing to take.

The most unusual aspect of the MT 386DX is its mini-tower chassis. The front-panel controls of the chassis, which measures 15.7 by 8.6 by 19.5 inches (HWD), lie behind a hinged door, which extends from the bottom to the top edge of the panel and across most of the width. On the upside, the door gives the machine an uncluttered look and protects the reset button from accidental depression. A small window in the door allows viewing of the indicator lights and two-digit speed indicator even when the door is closed. On the downside, you'll have to open the door to hit the reset or turbo button or to use either of the floppy drives. The MT 386DX comes with Panasonic 1.2MB and 1.44MB floppy drives and makes room for three additional half-height drives, all with front-panel access.

Unfortunately, the machine's chassis dealt us an unwanted surprise or two. After removing the three expansion cards from the machine, we found that reinstalling the cards was no easy task. While none of the adapters seemed to fit just right, the problem was most severe with the 16-bit Paradise OEM Super VGA adapter. The top lip of the adapter slot bracket hit against the top ledge of the slot opening before the card was seated far enough into the slot.

This improper spacing probably resulted from faulty motherboard mounting. The board that came in our test unit was supported by the chassis only near its side edges and bowed inward at the middle. Whether this sloppy mounting was the fault of the installation technician or the design of the chassis itself is difficult to say, but it was more than a trivial problem. A PC Labs technician finally got the board into a slot after all of our other attempts failed. It shouldn't have required so much effort, however.

An outfit named SIC Inc. manufactures the motherboard that came with our evaluation unit. The motherboard makes use of one ASIC chip by VLSI but depends primarily on discrete logic. AMI provides the BIOS.

The SIC board departs from the norm for 386 machines in a number of ways. For instance, the alternate processor speed is 16 MHz rather than the more typical 8 MHz. If you occasionally need to slow your system down to accommodate finicky software, a 16 MHz speed is not likely to do the trick.

In another departure from 386 motherboard design, the SIC board has two 8-bit slots and six 16-bit slots but no 32-bit slots. While this is somewhat unusual, it shouldn't be viewed as a problem: the motherboard accommodates a maximum of 16MB of 80-nanosecond RAM, 12MB via three banks of four SIMM connectors and an additional 4MB via one bank of 36 DIP sockets. Four 1MB-by-9 SIMMs provided the 4MB of RAM in our evaluation unit.

The processor RAM cache provided by the motherboard is one of the bright spots of the MT 386DX. Controlled by discrete logic, the cache accommodates a minimum of 64K static-RAM and a maximum of 256K. The 64K cache in our evaluation machine comprised ten 4-by-16K chips rated at 20 ns.

Micro Telesis equips the MT 386DX with an Ultrastor U12F/32 controller, which is another piece of good news. The Ultrastor, which comes with a 32K track buffer, boasts a number of unique features, including support of three floppy drives and the ability to coexist with other ESDI or IDE interface boards. The half-height ESDI hard disk in our evaluation unit, the NEC LR 56913, carries a 17-ms. rating and formats to a maximum capacity of 143MB.

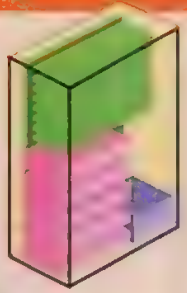
Other components that came with our unit include a Key Tronic 101-key keyboard of the no-click variety and a 14-inch Tystar Super VGA monitor. Standard-equipment ports comprise one parallel, one game, and two serial, all provided by one 8-bit adapter.

Micro Telesis provides only individual component manuals for the MT 386DX. The company indulges in a bit of obvious one-upmanship with its warranty, which covers parts and labor for 13 months. Service is via phone with overnight parts shipping. But, if our experience is any indication, demand on the technical support line may be outstripping manpower. We had problems getting correct answers from the technical support staff to fairly simple questions regarding motherboard components, such as what chip set and cache controller it used. This was the result not of a lack of technical knowledge on the part of the support representatives or of any lack of concern, but of confusion as to exactly which motherboard was installed in our machine.

MT 386DX, $2,899

The MT 386DX offers a few nice features and sells at an appealing price. It also turns in respectable results on PC Labs' benchmark tests, lagging slightly behind the pack only in video performance. In all, however, the difficulties that we experienced with the chassis of this machine and with the Micro Telesis technical support staff make this system difficult to recommend.

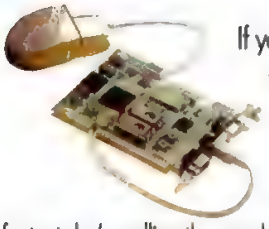
FACT FILE



MT 386DX
Micro Telesis Inc., 1260 Logan Ave., #A-2, Costa Mesa, CA 92626, (714) 557-2003.
List Price: With 2MB RAM, 64K cache RAM, 40MB hard disk, 1 2MB and 1.44MB floppy disk drives, VGA monitor, one parallel and two serial ports, DOS 3.3 or 4.01, $2,399; with 4MB RAM, 150MB hard disk, Super VGA monitor, $2,899.
In Short: The MT 386DX sells at an incredibly low price and offers several good features. But problems with the company's technical support staff and the evaluation unit's chassis may make this system a risky purchase.

CIRCLE 618 ON READER SERVICE CARD

VGA*WONDER+*
FASTER THAN VRAM



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While others follow, VGA*WONDER+* leads the flock with remarkable resolution, fabulous colors and outstanding value. VGA*WONDER+* offers an optimized architecture including fast 16-bit bus support and fast page mode memory which assures maximum speed…that's faster than VRAM and other VGA cards. Based on ATI's original award-winning VGA*WONDER** and available in 256K and 512K versions, you receive:

- High resolution non-interlaced and interlaced 1024×768 plus 800×600 graphics;
- 100% register-level compatible in all modes;
- Extensive drivers support including Windows 3.0*, Presentation Manager* and AutoCAD* Display List;
- Ergonomic 70Hz refresh rate in 1024×768, 800×600 and 640×480;
- Easy, switchless installation;
- Free Microsoft* compatible bus mouse;
- And much more.

With VGA*WONDER+*, performance is in the baaaaaaag.

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CIRCLE 540 ON READER SERVICE CARD

Mitsuba Corp.

Mitsuba 386-33

by Mitt Jones

The Mitsuba 386-33 numbers among the small group of low-cost machines truly worthy of consideration. From its Micronics motherboard to its sturdy desktop chassis, this system offers considerable quality at a very appealing price.

Equipped with 4MB RAM, 64K of cache memory, one 1.2MB 5.25-inch floppy drive, a 144MB ESDI hard disk, a Super VGA monitor, and DOS 4.01, the Mitsuba 386-33 carries a list price of $3,895. (Its base configuration price is $2,465, including 4MB RAM, 32K processor RAM cache, and one 1.2MB or 1.44MB floppy disk.) While this price is a bit steeper than that of several machines reviewed here, differences such as the Mitsuba's FCC Class B certification make the machine well worth the extra cost. In addition, Mitsuba reports that quantity discounts are available through its dealers. Mitsuba backs the machine through its dealers with a one-year, parts-and-labor warranty.

The Mitsuba chassis, which measures 6.5 by 21 by 16.8 (HWD) inches, adheres to the AT form factor inside and out. Of course, you do get a few enhancements, such as updated styling, plenty of rear-panel port cutouts, and a third half-height drive bay. The heavy-gauge metal also matches that of the AT.

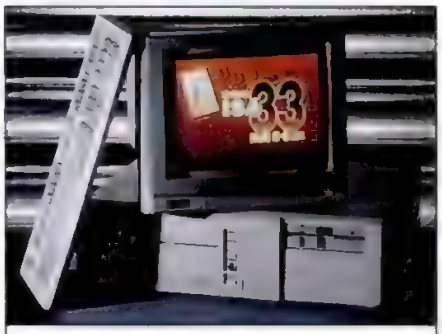
The Micronics motherboard employed in the Mitsuba machine is the same capable board used in the Matrix 386-33, also reviewed in this roundup. The BIOS is Phoenix, the chip set is Micronics, and the 121-pin PGA socket accommodates either an Intel 80387 or Weitek 3167 math coprocessor. An Intel 82385 provides the smarts for a 32K direct-mapped cache or, with 64K of static RAM installed, a 32K two-way set associate cache. Our unit came with a full 64K of 25-nanosecond static RAM.

The motherboard accepts a maximum of 4MB of 80-ns. motherboard RAM via four SIMM connectors. A Micronics 32-bit card, which was not provided with our evaluation unit, can hold 16MB, but the system will accommodate no more than 16MB of system RAM.

Of the seven 16-bit slots in our test unit, three were occupied, one by a Data Technology Corp. (DTC) ESDI disk controller, another by a Paradise OEM Super VGA adapter, and the third by an 8-bit Mitsuba I/O adapter, which provides one game port, one parallel port, and two serial ports.

Mitsuba teams the Data Technology DTC6280 controller with a full-height, 23-millisecond Toshiba drive, which formats to a capacity of 144MB. A Mitsuba TTL/Analog multi-scanning monitor, the 14-inch 710MH, provides a good match for the 16-bit video controller. The duo can handle a top resolution of 1,024 by 768 with four colors. The keyboard, made by Honeywell, doesn't offer much in the way of clicky key action but it does come with a 124-inch cord.

The machine turned in respectable marks on the PC Labs benchmark tests, ranking among the fastest of those reviewed here in processor and memory speed and landing in about the middle of the pack in video performance. Disk speed was on the slow side, whether the result of the Toshiba's 23-ms. average random access time or the controller's lack of a buffer.

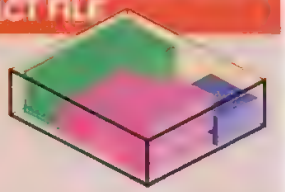


Mitsuba 386-33, $3,895

Our only major complaint with this machine is its lack of proper documentation. Mitsuba provides a nicely labelled three-ring binder and jacket with the system, but it fills the binder with the separate component manuals. This approach is understandable for vendors who toss machines together from the hot components of the week, but Mitsuba seems to use a fairly consistent set of components—Micronics motherboards, DTC disk controllers, Toshiba hard drives, Mitsuba monitors. One hopes the company will see fit to produce a manual in the near future.

Aside from its lack of custom documentation, the Mitsuba 386-33 compares favorably to much of the higher-priced competition and blows away just about everything in its own price range. If you're looking for an IBM or a Compaq, buy an IBM or a Compaq. If you're looking for a solid, low-cost machine, give the Mitsuba 386-33 a closer look.

PC LABS FACT FILE



Mitsuba 386-33
Mitsuba Corp.,
1925 Wright Ave., LaVerne, CA 91750; (800) 648-7822, (714) 592-2866.
List Price: With 4MB RAM, 32K cache RAM, 1.2MB or 1.44MB floppy disk drive, one parallel, one game, and two serial ports, $2,465; with 64K cache RAM, 144MB hard disk, Super VGA display, DOS 4.01, $3,895.
In Short: The Mitsuba 386-33 offers an admirably sturdy chassis and quality components at a compelling list price. Worth a closer look if you're searching for a bargain.

CIRCLE 619 ON READER SERVICE CARD

MultiMicro Inc.

MultiMicro MMI-3364T

by Mitt Jones

If MultiMicro Inc. were to sell the MMI-3364T at an outrageously low price, one might be persuaded to overlook its faults. As it stands, this machine must be seen for what it is: a mediocre clone selling at an unspectacular price.

Equipped to meet our standard configuration for this roundup, the MMI-3364T sells for $4,495. That price includes 4MB RAM, a 64K processor RAM cache, 1.2MB and 1.44MB floppy disk drives, a 150MB SCSI hard disk, a VGA display, DOS 4.01, and a 101-key Key Tronic keyboard of the no-click variety. Remove DOS 4.01 from the picture and substitute a 212MB IDE hard disk for the 150MB SCSI, and you've got what MultiMicro considers its basic configuration at a price of $4,295. All configurations include four I/O ports—one game, one parallel, and two serial.

Our test unit came in a solid tower chassis with a 250-watt power supply. Measuring 24.4 by 7.4 by 16.8 (HWD) inches, the chassis provides front-panel access to as many as six drives and comes with a full assortment of front-panel con-

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486/25	VIDEO OPTIONS Include Monitor & Video Adapter			
Drive Options	Mono	14" Flat Mono	VGA Mono	1024 VGA
w/84MB (19ms) IDE	$4745	$4795	$4945	$5145
w/200MB (16ms) IDE	$5245	$5295	$5445	$5645
w/330MB (16.5ms) SCSI	$6545	$6595	$6745	$6945
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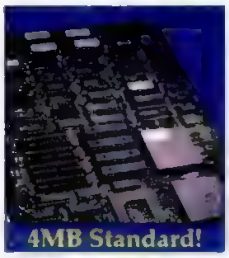
— Computer Shopper, October 1990

Swan Cache Systems: First For Features



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These systems are top-performers in their class, thanks to advanced algorithms and top-quality components. Each system comes with 4MB of RAM standard and both 5.25" and 3.5" high density floppy drives. The color VGA option includes Swan's super-fast video card with 512K on board plus our 1024 monitor to deliver crisp 1024 x 768 images. Many other video options are available—call for details.

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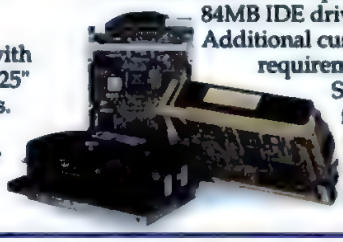

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— PC Sources, November 1990

386/25	VIDEO OPTIONS Include Monitor & Video Adapter			
Drive Options	Mono	14" Flat Mono	VGA Mono	1024 VGA
w/42MB (19ms) IDE	$1795	$1845	$1995	$2195
w/84MB (19ms) IDE	$2045	$2095	$2245	$2445
w/200MB (16ms) IDE	$2545	$2595	$2745	$2945

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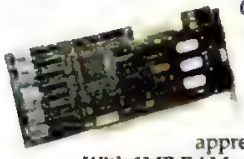

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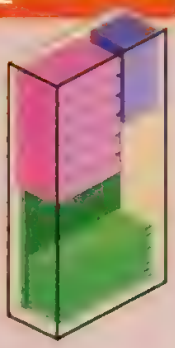

MultiMicro MMI-3364T
MultiMicro Inc., 582 Folsom St., San Francisco, CA 94105; (800) 848-4256, (415) 979-0140.
List Price: With 4MB RAM, 64K cache RAM, 212MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives, VGA monitor, one parallel, one game, and two serial ports, $4,295; with 150MB SCSI disk, DOS 4.01, $4,495.
In Short: The MMI-3364T comes in a solid tower chassis, offers capable performance, and comes with one year of on-site service, but the package as a whole lacks the minimal polish you'd expect for its list price.

CIRCLE 620 ON READER SERVICE CARD

trols, including reset and turbo buttons.

Inside the machine, all components but the all-important motherboard bear names that are at least somewhat familiar. The SCSI controller, a Future Domain TMC-885, runs the TEAC floppy drives and 24-millisecond Toshiba MK 156FB-I hard disk, which formats to a capacity of 150MB. The controller uses a modified 8-bit interface but requires a 16-bit slot.

The 16-bit Orchid ProDesigner II video board came equipped with 512K RAM for support of Super VGA modes, but the Tatung 1496G monitor provided with our

MultiMicro MMI-3364T, $4,495

evaluation unit is capable only of VGA resolutions.

The motherboard itself, manufactured by a company named Technology Power, eschews the popular chip sets in favor of discrete logic and makes use of AMI BIOS. The board runs the I/O bus at a safe 8 MHz and the processor at either of two speeds, 10 MHz or 33.5 MHz. Neither system nor video BIOS shadowing is supported.

The processor RAM cache, also controlled by discrete logic, employs up to 256K of 20-nanosecond static RAM. The 64K cache in our test unit used ten 4-by-16K chips.

The system accommodates up to 16MB of 32-bit memory, 8MB via motherboard SIMM connectors and 8MB on a 32-bit add-on card. The memory arrangement is row/column rather than the faster interleaved or interleaved page, but Technology Power has at least partially made up for this by using 70-ns. memory. Our 4MB of motherboard memory came in the form of four 9-by-1Mb SIMMs.

In addition to the 32-bit proprietary slot, which can also accommodate 8- and 16-bit cards, the Technology Power board provides one 8-bit and six 16-bit slots. With the video adapter, disk controller, and 8-bit I/O adapter, our fully configured machine should still have left us with five free slots. Instead of utilizing the port cutouts on the back of the chassis, however, MultiMicro inexplicably mounted two of the ports in a slot-bracket, effectively reducing the number of open slots to four.

In another odd move, MultiMicro tidied up the inside of the system by securing the power leads into one bundle and folding together excess lengths of ribbon cable, but all of this was achieved with the use of masking tape. Aside from being a shoddy solution to a relatively simple problem, this indiscriminate use of masking tape can cause serious problems. Give the tape sufficient time to dry out, and you may well end up with a blocked power-supply fan.

The MMI-3364T turned in mixed results on PC Labs' benchmark tests. The machine edged out in front on the Instruction Mix and Floating Point tests but lagged toward the rear on Conventional Memory and Disk Throughput tests. Video performance was respectable despite the machine's lack of BIOS shadowing.

MultiMicro provides little in the way of documentation with the MMI-3364T. Our unit came with a three-ring binder bearing the MultiMicro name, but the binder held only the video utilities diskettes, two slim component manuals, and a few other small items, all of which amounts to a total thickness of three-eighths of an inch. You also get the Orchid manual and motherboard manual, but the motherboard manual doesn't fit into the binder and the Orchid manual lacks the three necessary holes. Of course, you can punch the holes yourself.

The MMI-3364T comes with one year of free on-site service, provided through Repair Technologies International. Once the on-site contract expires, MultiMicro supports the machine via phone with parts shipping.

The MultiMicro MMI-3364T is not a bad machine, and the free on-site service is a definite plus. All things considered, however, the package as a whole simply doesn't inspire confidence. MultiMicro reports that it has stopped using masking tape on the inside of its machines and has begun running the I/O ports to the back-panel cutouts, but this is the kind of detail you expect a company to get right the first time. If you're willing to put up with mediocrity for the sake of a low price, you'll find less-expensive machines of comparable quality elsewhere in this roundup.

Novacor Inc.

Novas Optimum 386-33

by John R. Quain

Novacor is ballyhooing its $3,795 Novas Optimum 386-33 mini-tower as the first 33-MHz 80386-based machine with a programmable chip set. What this means is that there are some adjustable features

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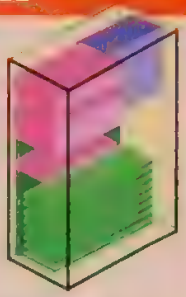

Novas Optimum 386-33
Novacor Inc., 1841 Zanker Rd., San Jose, CA 95112. (800) 486-6682, (408) 441-6500
List Price: With 1MB RAM, 64K cache RAM, 1.2MB floppy disk drive, CGA monochrome display, one parallel and one serial port, AT-style case, $1,766; with 4MB RAM, 158MB hard drive, Super VGA color display, DOS 4.01, second serial port, mini-tower case, $3,795.
In Short: The Novas Optimum 386-33 mini-tower from Novas has some appealing features and faster than average perfomance results. Unfortunately, poor interior craftsmanship and a Class A FCC certification make it a less-than-optimal buying choice.

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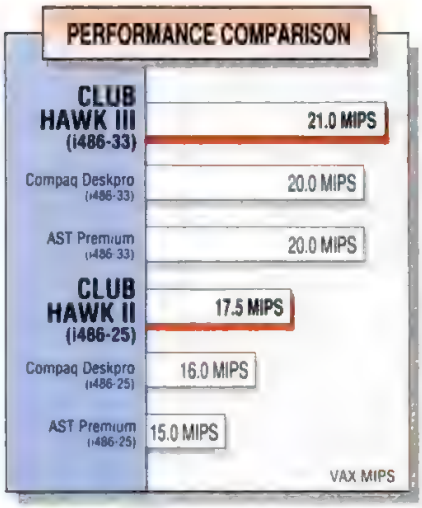

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to the OPTI and Chips and Technologies board and 64K RAM cache controller. When considered along with the system's above average performance, these features look attractive—especially if you hate poking around inside a PC searching for jumper switches. Be forewarned, if you start to poke around inside this PC, you'll find that some of the finer points of construction have been overlooked.

The programmable chip set, configured to the *PC Magazine* standard, allows you to perform system adjustments from the extended CMOS setup, including al-

Novas Optimum 386-33, $3,795

tering the number of caching lines from 8 to 16 bits, switching wait states (0 or 1), activating RAM shadowing (system and video), and changing interrupts and bus speeds (12 MHz, 10 MHz, or 8 MHz). The last is particularly useful if you have an old expansion board you just can't part with. For the security conscious, the current AMI BIOS also supports password protection. Documentation for these features was slim but the company claims user-friendly manuals are in the works.

Novacor delivered the Optimum with 4MB of RAM expandable to 8MB on the motherboard using 80-nanosecond 1MB SIP packaging, which is harder to find at competitive prices when you want to upgrade. Moreover, the SIPs on the motherboard blocked one of the expansion slots, preventing the use of a full-length card (only a half-length would fit). This was disappointing, but not unexpected in a mini-tower design. Of the eight slots in the review machine two 16-bit slots were occupied by the video card and hard disk controller, and the lone 8-bit slot was filled with an I/O board. A proprietary 32-bit 8MB add-in memory board is available from Novacor for $800. If you still feel bootless you can spring for additional 2MB upgrades at $200 apiece. Novacor rates the Optimum's processor for 25-MHz and 33-MHz operation and its ISA bus at 8 and 16 bits.

Most discomfiting about the Novas Optimum was the shoddy craftsmanship inside. Four alkaline batteries for the clock were swathed in plastic and taped to the side of the power supply, blocking necessary ventilation holes. A standard lamp cord had been used to connect the power switch to the 200-watt power supply—not a confidence booster. Furthermore, the machine's speaker had been jury-rigged to the underside of the case where a hole was cut for it but no protecting screen was attached. This meant the speaker's magnet collected staples and pins off the desktop. This is a detail that should be repaired. Lastly, the front panel reset lamp remains on during operation.

Given this description, and its FCC Class A certification, you might expect less than optimum performance from Novacor's machine. On the contrary: Though varied, the PC Labs benchmark test results were respectable. The ESDI-governed 150MB Maxtor hard disk produced a slow time (61.48 seconds) on the small records DOS File Access test, but showed far better performance on the large records (4.85 seconds) and BIOS Disk Seek trials (14.89 seconds). At 0.25 seconds on the Conventional Memory test, it was topped by only one other 386 in this review. Video performance times were equally impressive.

Only one other 386 in this review topped Novas on the Conventional Memory test.

The Optimum's Super VGA card is Novacor's own and uses a Chip and Technologies 45C controller chip. The Novas Optimum arrived with a 14-inch Relisys VGA monitor, so if you want the full potential of the card, add a few bucks for the monitor upgrade. Novacor offers a $745 Sony 1304 as its next step up in Super VGA that costs $400 more than the Relisys model. Rounding out the system were a couple of Teac 1.2MB and 1.44MB floppy disk drives, which together with the full-height hard drive leave one half-height bay vacant.

With its limitations on possible expansion and its jerry-built appearance, this mini-tower isn't a reliable LAN server candidate by any means despite a one-year warranty on parts and labor. On the other hand, at its below-$4,000 price point, a user who feels at home dealing with the somewhat minor annoyances of poor construction details may find it worth considering as a speedy business machine for general applications.

Peregrine Computers

Peregrine 386/33SF

by John R. Quain

Flying under the somewhat corny banner "Computers With Wings," the $3,999 Peregrine 386/33SF configured for this review is definitely no turkey. This small-footprint model not only has attractive plumage, it also comes with enough power to earn its keep in the office or at home. Moreover, the 386/33SF will find itself alien in few environments, especially with its 4MB RAM, 161MB hard disk, Super VGA color display, and a good assortment of software. Even at its $2,999 base price, it comes with 2MB RAM, *Microsoft Windows* 3.0, DOS 4.01, *LIM* 4.0, disk caching software, and a Microsoft Mouse installed as standard features.

To get the full power of a 33-MHz 386 system into a small footprint, Peregrine saves space inside with a couple of nifty maneuvers. A compact 200-watt power supply is used, along with an XT-size Atronics motherboard, and an unusual controller card built by Informtech. Using IDE controllers, a single 16-bit card handles not only the floppy and hard drive connections, but one parallel and two serial ports plus a game port. There are screw-on 25-pin connector holes in the back of the case but they don't currently accommodate the 15-pin game port, which takes up an extra slot. Remove the game port, and there are six free expansion slots.

Space-saving RAM packaging is laid down in 70-nanosecond 1MB SIMM modules between the slot connectors, allowing for a total of 8MB on the motherboard, with an additional 8MB of memory available on a $399 32-bit add-in card. Included with this is an up-to-date AMI BIOS and keyboard-selectable wait states

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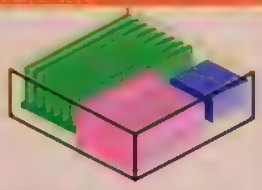

Peregrine 386/33SF
Peregrine Computers, 110 East Canal St., Troy, OH 45373; (800) 326-7015.
List Price: With 2MB RAM, 64K cache RAM, 40MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA, DOS 4.01, *Windows* 3.0, mouse, $2,999; with 4MB RAM, 161MB hard disk, Super VGA color display, second serial port, $3,999.
In Short: Mail-order's behind the name, home market's the game with the Peregrine 386/33SF. It's an average computer with average price and performance.

CIRCLE 622 ON READER SERVICE CARD

of zero or one. The system board can accommodate an 80287, 80387, or Weitek 3167 coprocessor.

The Speedstar Super VGA card with a Tseng Labs chip set took flight and performed extremely well on PC Labs' Direct to Screen and Video BIOS test routines, putting the Peregrine in the top five in this category. Processor speed was above average, certainly enough for most business applications.

Storage devices included with the 386/33SF are two 1.2MB and 1.44MB drives

Peregrine 386/33SF, $3,999

from TEAC and a 169MB Quantum IDE hard disk, which leaves one half-height bay vacant. The Quantum drive DOS File Access and BIOS Seek test times failed to match the high performance of the video system, capturing one of the slower large records access times of 5.87 seconds. Peregrine offers an upgrade to a 200MB IDE hard disk for only $139. The only cost here is the room lost for Peregrine's $399 120MB internal tape backup option by migrating to a full-sized hard disk.

Nevertheless, it's an inescapable rule of small-footprint PCs that you have to give up some expandability either for extra power or extra space. The Peregrine is no exception. Even though it has the full array of eight slots, the last two are restricted to three-quarter or half-length cards by the intrusion of the 3.5-inch floppy disk drive.

However, for those wags who'll complain that the Peregrine is just a bird in a gilded cage, the company offers a full-sized tower case upgrade for a paltry $100, which gives you six half-height drive bays and plenty of room. A standard AT box is available at no extra cost, too. It's not as pretty as the small footprint model, but you'll get five half-height bays and unrestricted internal movement.

Part of the Peregrine 386/33SF package is a reliable Hi-Tek 101 key keyboard. Here's the rub of a very minor rap against it: There are no finger-position bumps on the F and J keys. Otherwise, it's a sturdy and responsive input device. Topping off the system's features, we also liked what we saw on the 14-inch MAG Computronic high-resolution Super VGA color monitor. Its image quality was good enough to recommend it for user's working with graphics packages.

The external construction of the 386/33SF elicits confidence, with firm and tight front-panel power, reset, and turbo switches. The accompanying user's manual, although preliminary, is lucid without assuming a great deal of knowledge on the part of the user.

According to the manufacturer, it's working on Class B FCC certification for the 386/33SF. Though the current Class A rating poses the question of a fly-by-night-operation, Peregrine is far from it. Our contacts with technical and support staff confirmed this. Furthermore, the one-year parts-and-labor warranty is covered through dealers. If you can't resolve your problem by using the toll-free technical support line, Peregrine will pay full shipping costs. Important considerations if your Peregrine ever breaks a wing.

Precision Systems Group

Precision 386/33

by John R. Quain

Any comfort gained at the sight of sight of familiar components under the cover a PC is quickly lost when it's discovered the parts don't perform well as a whole. The Precision 386/33 is a case in point. This 33-MHz 386 machine, which has strong potential as a number-crunching, graphics, or design workstation, turned out below-average scores on PC Labs' comparative testing results. Although none of its results landed it in the basement, overall, it hung in the bottom third of the 33-MHz crowd.

To the Precision's credit, this $4,265 test system includes 4MB RAM, a Paradise VGA 1024 card, a full-sized 152MB Seagate hard disk, 5.25- and 3.5-inch floppy disk drives from TEAC, a Western Digital integrated disk controller card, and a Magic I/O card from Everex. Precision saved a slot here by taking the second serial port off the Everex card to a cutout in the back of the case. The hearty 230-watt power supply and the Seagate hard disk eat up a considerable amount of space, but this machine can afford it. With all that installed, you still have one half-height drive bay, one 8-bit/proprietary 32-bit slot, and four 16-bit slots left open to make your own arrangements.

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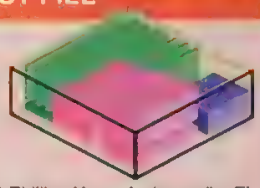

Precision 386/33
Precision Systems Group, 8728-48 Phillips Hwy., Jacksonville, FL 32207; (800) 326-4774, (904) 398-5008.
List Price: With 2MB RAM, 64K cache RAM, 1.2MB floppy disk drive, Super VGA card, one parallel and two serial ports, $2,275; with 4MB RAM, additional 1.44MB floppy disk drive, 150MB hard disk, Super VGA color display, DOS 4.01, $4,265.
In Short: Distinguishing itself only by its ability to run the Intel and Weitek math coprocessors simultaneously and offering plenty of memory, the Precision 386/33 doesn't seem very precisely constructed and turned in below-average test scores.

CIRCLE 623 ON READER SERVICE CARD

Precision 386/33, $4,265

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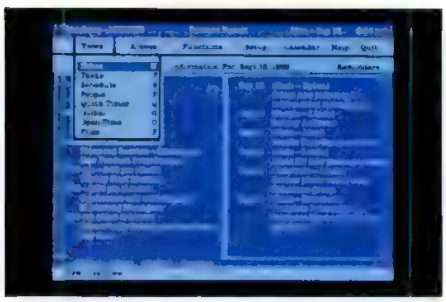

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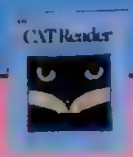

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On the machine's system board, Precision includes the Cyrix FasMath coprocessor as part of the Chips and Technologies chip set. If you choose, the motherboard can support Intel's 80387 coprocessor and Weitek's 3167 simultaneously, a very attractive arrangement for CAD/CAM use.

Maximum motherboard memory is 4MB of 70-nanosecond four-way interleaved RAM intended to increase performance with large programs. According to the company, if you're particularly hungry for power, the system will handle up to 64MB of RAM. Currently, Precision offers a 32-bit 16MB expansion board that piggybacks additional 1MB DRAM chips to bump the usable memory up to 20MB. To get the system up to the 64MB stratosphere, Precision will offer a daughterboard expansion card in the future. The 64K of 15-nanosecond RAM caching on the computer is provided by Intel's 82385 controller.

The fact that the Precision's 16-bit ISA bus runs at 8.25 MHz, and that there was no video or system shadowing under the Award BIOS, may have hurt the machine's test performance. Processor and memory times on PC Labs' benchmark tests were situated in the bottom third of the pack. Our Video BIOS routines showed consistently low marks, too. The Seagate hard disk, which is rated at 15 milliseconds, tested out at 16.96 ms. in the BIOS Disk Seek test—below average for the group. To assist the drive's performance, Precision includes a disk caching utility supplied by the motherboard maker, Hauppauge Computer Works. The utility, called 386 Boost, allows you to set the unit for track-by-track caching.

Also included with the 386/33 is DOS 4.01, a Hi-Tek keyboard, and a Super VGA monitor from CTX, which scores points for its front-mounted resolution controls. Nice features for users who have a considerable amount of graphics to run.

The system we tested was FCC certified for Class A operation only and came in a plain desktop case that seemed strained. In fact, the chassis was strained to flexing with the cover off. Indeed, the machine had already begun to warp under the weight of its own components. However, these components are from well-known manufacturers, and Precision has enough confidence in them to cover the parts for two years. The standard service warranty is for one year, and if you can't be helped through the company's toll-free technical support line, you'll have to ship it back to Precision if there are serious problems.

This time around Precision managed to distinguish itself in only two respects: its ability to run the Intel and Weitek coprocessors simultaneously and its promise of memory to burn.

Premier Innovations Inc.

Premier 9200

by John R. Quain

On first impression, the Premier 9200 certainly looks the part of a stalwart 24-hour-a-day LAN server. Standing more than 27 inches high, this full-tower 33-MHz 80386-based system with its locking case and carrying handle has all the construction and design potential of a workhorse server. The PC Magazine Labs tests paint this machine a horse of a different color, though.

The design and engineering points are all there: front panel controls, accommodations for up to 16MB of usable system RAM, a maximum of 128K RAM caching, eight standard expansion slots, six half-height drive bays, a fat 230-watt power supply, and two convection-current fans to keep the CPU running cool. All these features suggest that you could load up this machine for network duty. The only trouble is, the $3,900 Premier 9200 configured for our tests wouldn't make a particularly fast server. That specific system includes a 4MB block of RAM, 64K of processor RAM cache, a 177MB Imprimis IDE hard disk, and a VGA display among its features.

Of all the benchmark test scores for the Premier 9200, two stand out. The 1.71-second 80386 Instruction Mix test result, in particular, indicates overall slow system speed, placing the 9200 in the bottom third of the review machines tested. What is more, the notably poor 9.49-second showing on the DOS File Access test for large records, the slowest average access time of the group, will steer potential server buyers to other machines. However, since this result is a reflection of the 8-MHz speed of the 16-bit ISA bus, IDE disk controller, and disk speed, the culprit may be the underpowered Imprimis hard disk. Choosing a faster full-sized drive should improve the throughput results, though Premier offers limited IDE and no ESDI options.

Tatung makes the motherboard for the Premier 9200. Mounted with 60-nanosecond 1MB SIMM packages, the motherboard is limited to a maximum of only 4MB of DRAM, the amount installed for review. If you want more, you'll have to move to an expansion card. Premier offers a proprietary add-on board holding up to 12MB of RAM. The motherboard's Intel chip set controls 64K of 20-nanosecond RAM caching. Like most of the models in this roundup, the 9200's open sockets accommodate either the Intel 80387 coprocessor or Weitek 3167 coprocessor. Shadowing of the Phoenix ROM BIOS is provided, and both video and system shadowing can be disabled in CMOS setup when memory conflicts arise.

The 9200 arrived outfitted with a 16-bit Super VGA card, 8-bit I/O card, and hard disk controller card. This left only four slots open (three 16-bit and one 8-bit). After installing a LAN card, an additional memory board, a modem, and a bus mouse, the Premier 9200 would be full. However, closer inspection revealed that the installers didn't bother to use the 25-pin punch outs in the back of the chassis for the second serial connector. We checked, and the port could be moved over easily enough to free up the extra 8-bit slot. If you want to install a tape drive, there's room for it, even with the downsized Imprimis hard disk and the standard 5.25-inch Panasonic and 3.5-inch Toshiba floppy disk drives installed.

The 9200 comes with a Premier label VGA display coupled to a Super VGA card with a Trident chip set. Its slow 2.69-

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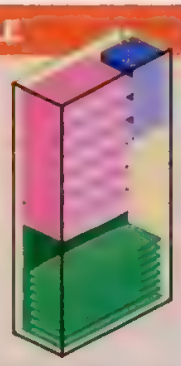
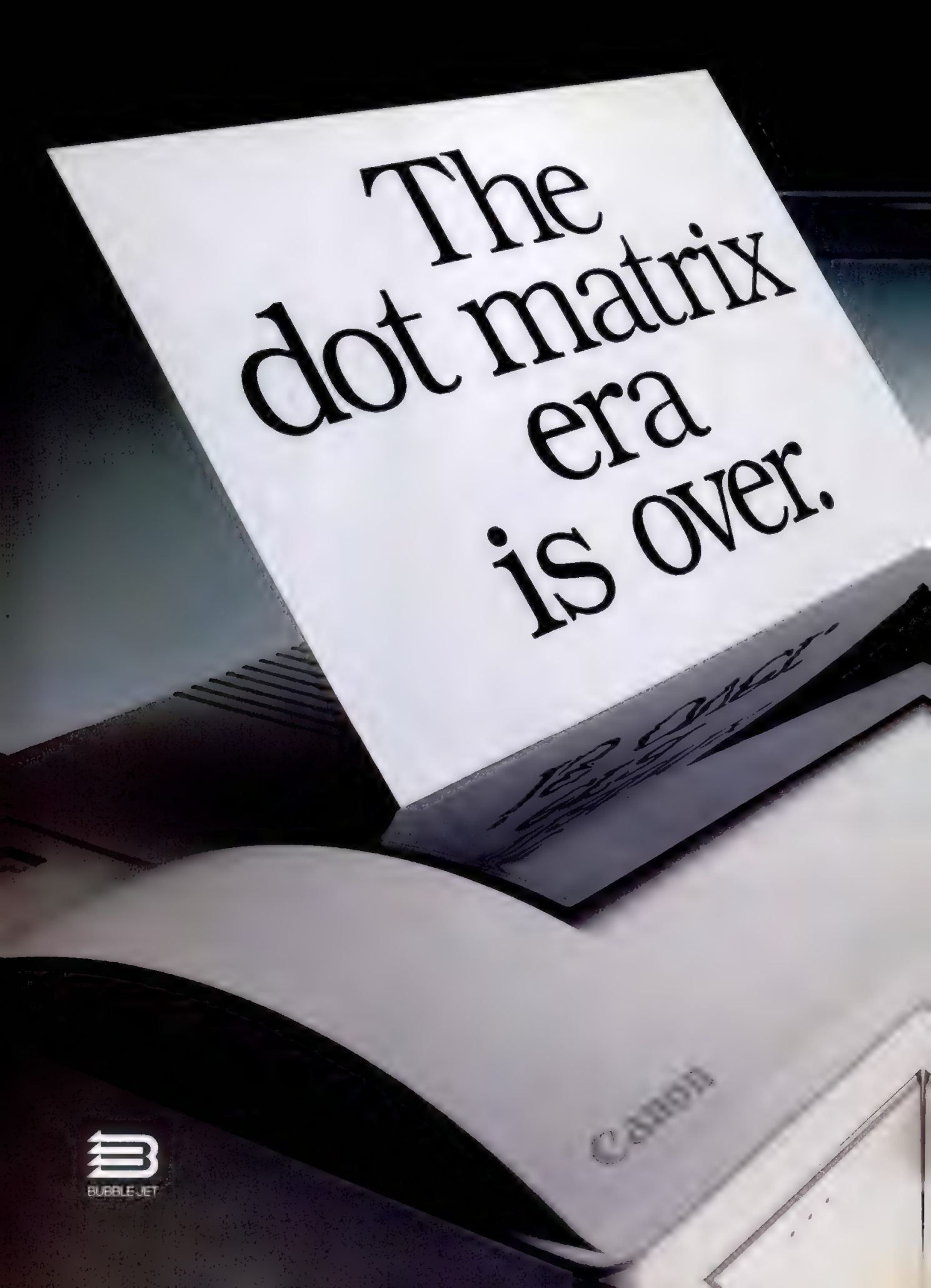


Premier 9200
Premier Innovations Inc., 10310 Harwin, Houston, TX 77036; (800) 347-1777, (713) 995-4433.
List Price: With 4MB RAM, 64K cache RAM, 40MB hard disk, 1.2MB and 1.44MB floppy disk drives, VGA color display, DOS 4.01, $3,799; with 177MB hard disk, additional serial port, $3,900.
In Short: A sturdy, expandable machine at a more-than-attractive price. Unfortunately, its undistinguished showing in some performance tests significantly decreases its appeal.

CIRCLE 624 ON READER SERVICE CARD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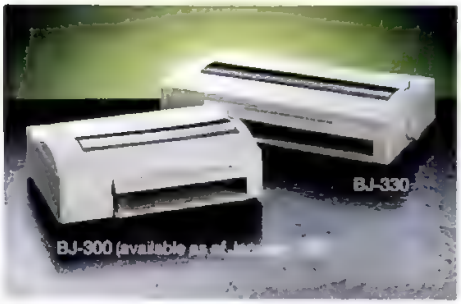

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CIRCLE 155 ON READER SERVICE CARD

Premier 9200, $3,900

second performance on the Direct to Screen test was much improved on the Video BIOS routines. Though not available for review, a Super VGA screen comes with the standard system, according to Premier. The vendor covers the 9200 with its standard one year, parts-and-labor warranty.

As a final note, the AT-style keyboard made by Forward Electronics seems a rather unworthy companion to the 9200. The keyboard did not have the solidity of the CPU, and its metal bottom scrapes along desk tops. Touch typing sessions reveal that there isn't much travel in the keys. Ironically, this only contributes to the system's workhorse impression. On-site service for the system is provided by TRW for a year. The machine also carries an FCC Class B certification.

With its promising appearance and feature potential, the Premier 9200 cries out to be used as a LAN server. Unfortunately, its poor processor and disk performance denies that appeal.

Quill Corp.

QTech 386-33

by John R. Quain

Judging by the Quill Corp. catalog, the QTech 386-33 seems to be aimed directly at the home office market. The QTech's sliding smoky plastic drive bay cover and hinged reset and speaker-off button panel adopt the familiar styling points of home electronic equipment. Similarly, the company's mail-order office supply background and its packaging of OEM computer components at bargain prices adopt successful home consumer marketing practices. Mail order is hot, and at $4,040 for a system with 4MB RAM, a 158MB hard disk, and a color VGA display among its features, the QTech 386-33 is the top catalog offering from this Illinois-based company. Quill's base 33-MHz 386-powered PC with 1MB RAM, monochrome monitor, and no hard disk lists at $2,499. In our tests, it certainly wasn't tops, but users looking for a bargain shouldn't be dismayed by this machine's performance.

OEM'd from Everex, the QTech's standard desktop chassis holds the motherboard mounted with 4MB RAM, 64K maximum of RAM caching, five 16-bit slots, one 32-bit slot, one 8-bit slot, an open socket for either the Weitek 3167 or Intel 80387 coprocessor, a Chips and Technologies chip set, and an integrated disk controller.

The system's 16-bit ISA bus can be toggled to run at a maximum of 16 MHz, and the system has three keyboard-selectable operating speeds of 11 MHz, 16 MHz, and 33 MHz. In the machine that we reviewed, two slots were occupied by the 8-bit Magic I/O card and a 16-bit Everex VGA card. For usable memory, up to 16MB of RAM may be installed in 80-nanosecond 256K and 1MB SIMM packages—8MB on the system board for $700 and 8MB on 32-bit proprietary card for $1,670.

You'll find other companies, such as Spear, peddling nearly identical machines. You won't, however, see similar offerings from Everex. A separate division of that well-known manufacturer is responsible for OEM equipment.

The QTech 386-33's performance on PC Labs' processor and memory benchmark tests showed the machine holding its own with the rest of the tightly knit pack, so power users shouldn't be disappointed. True, hard disk access times on the $1,200 158MB Maxtor system were not the best, with the 62.13-second DOS File Access (Small Records) test time ranking it in the bottom third. But the unit's respectable large records access speed of 4.78 seconds means the QTech could be pressed into service to manage a small LAN.

Times on the Direct to Screen and Video BIOS routines, while certainly not the worst, also fell into the bottom third of this issue's covenant of 33-MHz 386 PCs. Considering that the QTech doesn't offer video BIOS shadowing, the times aren't bad. If you're doing CAD/CAM work, however, you may want slightly better video performance, and you probably would want more detail than that yielded by the 14-inch Leading Technologies color monitor reviewed here.

Evidence of standard expandability is found in the QTech's AT-style case, which allows room for five half-height drives. The system came with a TEAC 1.2MB floppy disk drive and the full-sized Maxtor hard disk. A 3.5-inch floppy disk drive from the Quill catalog will set you back another $90, leaving one half-height drive bay vacant for additional storage needs. Though our unit didn't have a second serial port, one can easily be added without taking up an additional slot. A game port also can be added for a nominal charge.

A familiar Key Tronic AT-style keyboard—one cherished by many PC users—comes with this FCC Class B machine. Though the QTech's slim documentation will occasionally leave the first-time user in the dark, the potential buyers of this mail-order system aren't likely to be driven from this fairly priced, expandable system.

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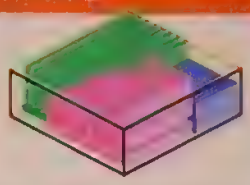
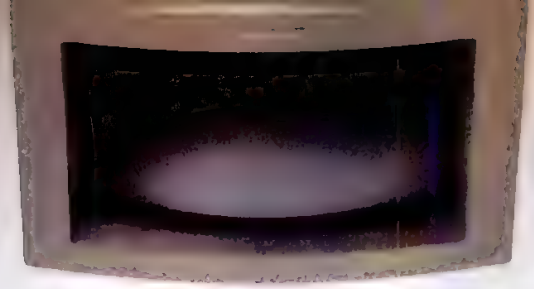


QTech 386-33
Quill Corp., 100 Shelter Rd., Lincolnshire, IL 60069; (708) 634-6650.
List Price: With 1MB RAM, 64K cache, 1.2MB floppy disk drive, CGA monochrome display, one parallel and one serial port, $2,499; with 4MB RAM, 158MB hard drive, Super VGA color display, DOS 4.01, second serial port, $4,040.
In Short: The QTech is offered by the Quill mail-order house. Average results and an average price contributed to its lack of distinction in our 33-MHz crowd.

CIRCLE 625 ON READER SERVICE CARD

QTech 386-33, $4,040



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THE INTENSE!... FACTS

TOUCHE 386/33	Gateway	Northgate
CPU-Upgrades to 486	No	No
Motherboard Manufacturer - AMI	??Changes??	??Changes??
RAM - 32 MB max.	16 MB max.	16 MB max.
Hard Drive - 200MB ESDI or IDE	150 MB	200 MB
Video - Sony 1304 "EDITOR'S CHOICE" NON-INTERLACED	Tatung (Generic) INTERLACED	NEC-3D INTERLACED
Tower - NO CHARGE	$200 Extra	NO CHARGE
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CIRCLE 633 ON READER SERVICE CARD

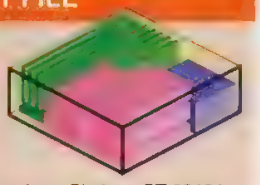
SAI Systems Laboratories Inc.

SAI 386/33

by Bill O'Brien

SAI Systems Laboratory really wants you to buy one of its computers. The company's functional base machine, a $1,995 system fitted with 1MB RAM, 40MB hard disk, and monochrome display, makes the SAI 386/33 seem like low-cost booty of the 386 dollar war. Even with a configuration upgrade to *PC Magazine*'s standard 4MB of RAM, 64K RAM cache, a 1.2MB or 1.44MB floppy, a 150MB hard disk, a Super VGA display setup, and DOS 4.01, SAI's 33-MHz machine is a comparative steal at $3,395.

FACT FILE



SAI 386/33
SAI Systems Laboratories Inc., 911 Bndgeport Ave., Shelton, CT 06484; (203) 929-0790.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB floppy disk drive, monochrome display system, one parallel and two serial ports, $1,995; with 4MB RAM, 150MB hard disk, Super VGA display system, DOS 4.01, $3,395.
In Short: Average performance, sparse documentation, and a Class A rating keep the SAI from being a good home computer, but it has sufficient performance prowess and a low-enough price to become a reasonable blue collar machine.

CIRCLE 626 ON READER SERVICE CARD

Make no mistake, this is a no-frills computer. The case is a standard AT box with five half-height bays, three of which have front access. Its standard reset and turbo buttons are controlled from the front panel. Power for the 386/33 is supplied by a 200-watt Le Amatic unit. Take the cover off and you'll find evidence of major diagonal flex in the chassis. As with any mail order computer, you are well advised to remove the cover and check that all of the boards and chips are firmly seated in their slots and sockets.

SAI 386/33, $3,395

Inside the case you'll find an 80-Data motherboard with two 8-bit and six 16-bit slots. The installed VGA card, disk controller, and I/O board leave five slots available for expansion. Discrete components take the place of a large scale integrated 80386 chip set, but AMI BIOS chips are plainly visible for those who need the comfort of a name brand. Likewise, an Intel 82386 cache controller directs the 64K of 20-nanosecond cache RAM that link the processor to the installed 4MB of 80-ns. system RAM. The motherboard will handle 8MB of system RAM in SIP configuration before you'll need to resort to an add-in card to take the system up to its 16MB maximum.

For review, SAI provided a $300 200MB Conner Peripherals IDE hard disk with the machine that PC Labs' BIOS Disk Seek test clocked at a 15.88 millisecond average access time. While this is a fast access time, the drive is leashed to an embedded AT controller that hinders the true throughput potential. SAI offers 80MB, 150MB, 300MB, and 600MB alternative ESDI drives at $700, $995, $1,895, and $3,295, respectively, that couldn't help but improve access times.

Video is the performance bonus from the SAI 386/33. Although devoid of any name, the 16-bit VGA card carries a Western Digital chip set and did quite well on PC Labs' video BIOS scrolling benchmarks with elapsed times of 0.33 and 1.04 seconds. Coupled with the NEC 3D monitor, the display system is more than adequate for video intensive software applications.

Two words describe the SAI 386/33 documentation: slim and none. Four manuals arrived with the system and it's a stretch to actually call them manuals. Two of them are for the VGA card, one covering the hardware and the other describing the VGA utility software. NEC's own user manual for the 3D monitor was included, of course, and the quartet was completed with a 22-page document describing the various options available on the 80-Data motherboard. You won't find documentation and guidance on system operations and setup.

Naturally, none of that will matter if you're one of the personal computing cognoscente. Indeed, the SAI 386/33 may be best appreciated by those who need a limited amount of support. Its lack of an FCC Class B rating keeps it from being a home machine of choice, but it could be a good machine to stock hackers and programmers in your shop.

Swan Technologies

Swan 386/33

by Bill O'Brien

Forget the analogies; the Swan 386/33 computer is neither graceful nor flighty. Locked in a tower case, its 4MB of RAM, 64K of cache memory, 200MB hard disk, and Super VGA display system lets you into the realm of 33-MHz 386 computing for $4,344 at our standard configuration. The budget conscious can save $250 by opting for the desktop version, but there's something about a 33-MHz machine that begs for the stronger impression of a tower case.

When submitted for review, the machine had no FCC Class B rating; if certification comes through, however, the Swan 386/33 would make an ideal power system for the office at home.

Swan's front-access tower case, which holds 6 half-height drives, puts large round power, reset, and turbo buttons up top where they're easily accessible. The power button is color-coded green. Since the legends on the case are difficult to read, the reset and turbo buttons would benefit

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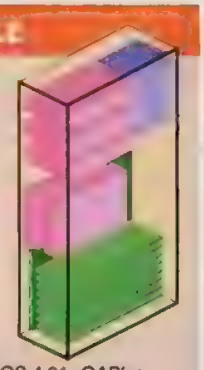
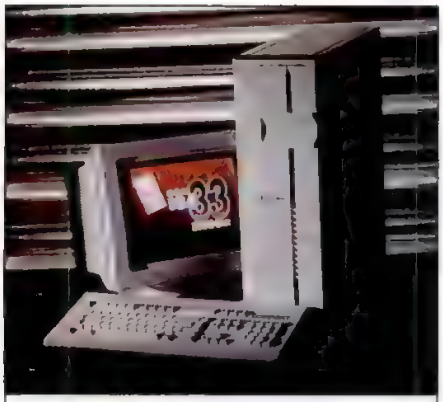


Swan 386/33
Swan Technologies, 3075 Research Dr., State College, PA 16801; (800) 468-9044.
List Price: With 4MB RAM, 32K cache RAM, 1.2MB and 1.44MB floppy disk drives, monochrome display, one parallel and two serial ports, keyboard, DOS 4.01, *QAPlus*, *Micronics EMS* 4.0, $2,495; with tower case, 64K cache RAM, 200MB hard disk, Super VGA display system, $4,344.
In Short: If the overall performance of the Swan 386/33 wasn't so good, you'd hardly notice the slight drop in hard disk performance. Even with a Class A FCC rating, the system receives an unqualified thumbs up.

CIRCLE 627 ON READER SERVICE CARD



Swan 386/33, $4,344

from color coding to prevent accidents.

As reviewed, the Swan included both 3.5- and 5.25-inch floppy disk drives, plus a 200MB Conner Peripherals hard disk. The system's 230-watt power supply and additional fan provide power and cooling for up to six devices in its bays. Five half-height bays and a 200-watt power supply come with the desktop version.

Swan chose an 8-slot Micronics ASIC motherboard as the platform for its 386/33 computer. The hallmark of this motherboard is its reliance on a single large-scale integrated chip to handle DMA and interrupts, while the balance of the 80386 functions are relegated to discrete integrated chips. The Micronics board uses an Intel 82385 to direct the 2-way associative RAM cache and the reviewed machine contained 64K of 25-nanosecond devices. They link the processor to 4MB of 80-ns. system RAM in 1MB SIMM packages. Should you need to expand the system beyond this 4MB motherboard maximum, additional RAM can be added to the system's 32-bit slot to bring the 386/33 to its 16MB limit. Swan sells memory upgrades in 2MB increments. The first upgrade includes the memory board and sells for $249. A 4MB jump boosts the price of the option to $469.

PC Labs' benchmark tests for the 80386 Instruction Mix, Floating-Point Calculation Without Coprocessor, and Conventional Memory show the Swan 386/33 as a performance checkerboard. Its processor and RAM performance set the machine firmly among all but the slowest of the machines reviewed. Though the Swan fared well among processors, it lost its performance edge in the disk access tests. The strength of Swan's 16.55-millisecond drive carries it through the small record DOS File Access test competitively at 55.07 seconds. However, the 5.41-second throughput speed displayed in the large record DOS File Access test is where the system's edge dulls. A quality ESDI hard disk would do the job, but an ESDI option is not listed among those Swan sells.

Then there's video. Visually, the Qume Multiscan 850 monitor is excellent. Swan's generic 16-bit VGA card, with a Tseng Labs chip set, brings the 386/33's sharp performance back with exceptional numbers on the Direct to Screen and Video BIOS Routines. It's noteworthy to mention that the Swan 386/33 is bereft of video and BIOS shadowing. The system earns the good processor and video numbers without its benefit. Should you want to add shadowing, a utility disk included with the 386/33 contains software that will reserve an area of memory and implement shadowing. It might be an interesting experiment to see what additional performance gains you can eke out of the Swan, but if you're running software that works in protected mode, such as *Windows*, the Swan 386/33 works well enough in stock trim to make shadowing a dubious choice.

Neither an FCC Class A certification nor an irregular dip in hard disk performance can prevent the Swan 386/33 from getting a strong recommendation as an ideal home or small office machine.

Tandon North America

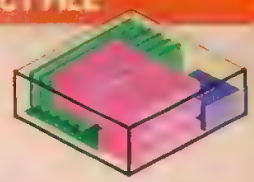
Tandon 386/33

by Bill O'Brien

If you're a manufacturer beset by blistering competition in one area, you might look to expand into other areas. Give Tandon credit for being able to take the heat in the crowded kitchen of desktop computing. Long known for its premier line of hard disks, Tandon's latest entree on the 33-MHz 386 menu is a machine that, under *PC Magazine*'s standard configuration of 4MB RAM, 64K cache memory, 110MB hard drive, a choice of 1.2 or 1.4MB floppy drives, monochrome VGA display, 2 serial and 1 parallel ports, and DOS 4.01, lists for $3,999.

Tandon 386/33, $4,999

PC FACT FILE



Tandon 386/33
Tandon North America, 405 Science Dr., Moorpark, CA 93021; (805) 378-6017.
List Price: With 4MB RAM, 64K cache RAM, 110MB hard disk, 1.2MB floppy, monochrome VGA display system, one parallel and two serial ports, DOS 4.01, $3,999; with 256K cache RAM, 200MB hard disk, Super VGA display system, $4,999.
In Short: As can be expected from a respected hard disk manufacturer, the Tandon 386/33's fine hard disk performance is the point of distinction in choosing this otherwise ordinary 386-based system.

CIRCLE 628 ON READER SERVICE CARD

As delivered for testing, the Tandon 386/33 came with 4MB of RAM, a single 1.2MB floppy drive, 200MB hard disk, and a Super VGA display system bundled with DOS 4.01, *Windows* 3.0 and a Microsoft Mouse for a $4,999 package. For about $1,000 more (excluding *Windows* and the mouse), the manufacturer offers the same standard configuration with 256K caching memory, a Princeton Graphics or NEC 14-inch display, and choice of floppy disk drives.

Tandon's pastel stripe has become a signature for its products. Here a turquoise strip marks the top of the soft, rounded edges of this desktop enclosure. Under the stylized face plate, the chassis is a conventional AT design with five half-height drive bays, three of which have front access. Atypical for 80386-based systems, the power supply with this case is rated at only 190 watts.

The platform for the Tandon 386/33 shares Micronics and Tandon labels. The motherboard uses discrete components to govern 80386 operations in lieu of large scale integrated circuits. Intel's 82385 processor controls the 64K of RAM cache and while the review system contained 20-nanosecond static RAM chips, Tandon switched to 25-ns. devices just after

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STACKER

the machine was shipped for testing. More than likely, the performance differential will be negligible.

Of the eight slots on the motherboard, one is used by the video card, and another is the home for the combination floppy drive controller, parallel/serial interface, and an embedded AT controller link to the 16-bit ISA bus. A third is a proprietary 32-bit memory expansion slot that provides all of the system memory and held 4 megabytes of memory in 256K and 1MB DIP packaging with an 80-ns rating. Tandon claims a 16MB maximum for the system, with 8MB on the card itself and an additional 8MB on a daughtercard at an upgrade cost of $369 per 4MB of RAM. PC Labs' suite of processor and memory benchmark tests show no apparent performance loss with the use of carded memory.

With the build-up about Tandon's hard disks, it would be disappointing if the 200MB drive in this machine didn't live up to its reputation. It does, with a scorching 4.09-second score on the large record DOS File Access test and a respectable 15.03 millisecond time on the BIOS Disk Seek test. Naturally it bears the Tandon logo, but while this 15-ms. IDE drive scores an average rating for small record handling, its large record results are exemplary. It gobbles down large bits of data, displaying the second fastest throughput time of the group for this test segment.

Tandon's choice of video cards is not as pleasing. Here too, the 16-bit Super VGA card carries the Tandon name. The Zymos chip set keeps video order, but its performance falls well below average in all but the Video BIOS Routines Without Scrolling. Tandon lists no other video board options even though the system would certainly benefit from the added speed of something like an Orchid ProDesigner II card. Visually, the companion Princeton Graphics Ultra 14 monitor provides excellent color and crisp character representations. The pair prove adequate for most applications that are not video intensive.

On a strict dollar basis it's difficult to distinguish Tandon's 386/33 computer from many of the others in this review. Its one-year warranty on parts and labor is nearly standard at this point, as is the on-site service plans that are optionally available. Even the manuals are not distinct enough to give the computer an edge. The main advantage this system enjoys is the superlative hard disk performance which makes the 386/33 a logical choice for environments with demanding hard disk needs.

Tatung Co. of America Inc.

Tatung TCS-8600T/33

by Bill O'Brien

Tatung has dropped the second shoe with the 33-Mhz version of its TCS-8600T cache computer. While you won't be getting the most expensive computer reviewed, you will pay a $5,499 premium for the 4MB of RAM, 150MB hard disk, and VGA display system in the tower configured to *PC Magazine*'s standard. However, Tatung may well have found a good combination of components to justify that premium.

The tower enclosure is solidly built and contains six half-height bays. Front panel controls include power, reset, and turbo switches with LEDs to indicate turbo mode and hard disk activity. A hefty 230-watt power supply comes with the tower, and Tatung has tacked on an additional cooling fan at the front of the unit to counter heat problems.

Tatung claims this eight-slot motherboard as its own. The board's 64K of 20-nanosecond RAM cache for the Intel 82385 holds sockets for an additional 64K. BIOS functions are governed by a Phoenix ROM, and there's an open socket for an 80387 coprocessor. The system's ISA bus is rated for speeds of 8 MHz and 12 MHz.

The 8600T/33's 16MB maximum of system RAM capacity is defined in part by the standard 4MB of 80-ns. motherboard mounted SIMM packages, the most that will fit. Normally, further expansion requires buying an add-in board, but Tatung drops that requirement—as far as paying for one is concerned. The 12MB expansion card is actually a daughterboard mounted with 1MB SIMMs that attaches directly to the motherboard and is included with the system—albeit without the chips.

When *PC Magazine* last looked at the 25-Mhz version of Tatung's tower, it was filled to overflowing with a 300MB ESDI drive. While not as impressive for its sheer physical size, the $1,200 150MB Seagate ESDI unit in this computer displays above-average performance in the DOS File Access tests for small and large records. The tradeoff in drive also means a lower overall price that moves the TCS-8600T/33 closer to its competition. The upgrade to 300MB would bump the price up by $400 and there's also a 600MB ESDI drive available for an additional $1,250 should you decide to make the 8600T/33 a server.

> Tatung's tower enclosure is solidly built and contains six half-height bays.

As you might expect from a company that was primarily a monitor manufacturer, the Tatung CM-1496 monitor is excellent. This version is a VGA-only display, with the $799 1,024-by-768 CM-1498X Super VGA display an available option. The companion TVGA-16 video card is a 16-bit VGA device, but it has little performance to offer on either PC Labs Video BIOS with Scrolling or Direct to Screen tests. The Paradise chip set doesn't tow the mark on this card. Tatung offers a Super VGA card called the Omni-VGA that may boost performance.

At first glance the documentation for the system won't look like much at all, but

FACT FILE

Tatung TCS-8600T/33
Tatung Co. of America Inc., 2850 El Presidio St., Long Beach, CA 90810; (213) 637-2105.
List Price: With 2MB RAM, 64K cache RAM, 1.2MB floppy disk drive, one parallel and two serial ports, DOS 4.01, $3,799; with 4MB RAM, 1.2MB and 1.44MB floppy disk drives, 160MB hard disk, VGA color display, $5,499.
In Short: There's nothing wrong with a premium price for a premium system and the TCS-8600T/33 fits that profile. While other video options might be worth investigating, Tatung's service and support make this a very attractive computer.

CIRCLE 629 ON READER SERVICE CARD

Tatung TCS-8600T/33, $5,499

the small, spiral bound manual is deceptive. Typeset on slick paper, it provides a walk through the computer's setup and operations in simple language. If this isn't your first computer you can ignore the manual; if it's your first machine you'll love the extra help.

Tatung isn't dragging its heels in the service and support areas either. Both parts and labor are covered for a full year with 120 days of on-site coverage after purchase provided by Memorex Telex. It's a nice concession to the fact that most problems occur during the first three months of ownership. Support is no further away than your telephone, and if the few calls needed to confirm how the TCS-8600T/33 works are any measure of their responsiveness, Tatung should prove relatively fast and reliable.

While the $500 to $1,500 premium you'll pay for this system may seem harsh, it is an FCC Class B device that fits best into your office at home. Tatung's choice of an ESDI drive and the addition of on-site service are premium features and they cost money. Fortunately, it's money well spent on this system.

Televideo Systems Inc.

Televideo Tele386e

by Bill O'Brien

Once known only as a manufacturer of network terminals, Televideo's product line now includes 80386-based machines for the 33-MHz environment. Televideo's Tele386e is not an outstanding example of the genre, and configured to our standard 4MB of RAM, 200MB hard disk and VGA display system, its $7,609 price tag outdistances the majority of the field. Performance potential and Televideo's on-site service and support package make the machine worth looking at, though.

Televideo's eight-slot motherboard is an enigma of sorts. While Televideo claims the board as its own, a silk-screened emblem under the stick-on label pronounces the board's point of origin as Wong's Electric Co. Be that as it may, there's no masking the motherboard's performance. While discrete logic makes up for the lack of a large scale integrated 80386 chip set, AMI provides the BIOS that motivates the machine. An Intel 82385 cache controller manages the 64K of 20-nanosecond static RAM. Together with the 4MB block of 80-ns. system RAM, the Tele386e motherboard manages to rank solidly among the top performers. Be mindful that this is one of the handful of motherboards that does not use either system or video BIOS shadowing to garner its position.

Memory expansion is provided on the motherboard to a maximum of 8MB while additional upgrades beyond that level require a plug-in memory card for the Tele386e's proprietary 32-bit slot. The add-in board carries 100-ns. SIMMs which are extremely slow for a 33-MHz computer. Normally the cache will absorb the disparity, but it's likely that the system could experience up to three wait states on a cache miss.

Atypical for many of the systems reviewed is Televideo's choice of hard disks. It's a $539 Maxtor LXT-200S SCSI hard disk and it bucks the trend of machines using embedded AT drive controllers. Whether or not there's any real performance gain is dubious since the drive was literally clobbered by the DOS File Access test using small records. The SCSI interface comes into better light when viewed from the results of our test using large records. Here the interface's inherently faster throughput potential boosts the drive into the top five.

For a company that made its name in video terminals, one would hope for video greatness from Televideo. The reality is that the Tele386e's 13-inch Televideo/Samsung VM200 video system shows greatness in appearance only, not on the PC Labs suite of video tests. On the Direct to Screen test, the display's 16-bit Western Digital VGA card, with Paradise chip set, scores a reasonable 2.08-second time on direct writes to the video hardware.

Televideo Tele386e, $7,609

However, the system becomes recalcitrant when asked to perform Video BIOS Routine functions—nearly the slowest times of the test group. This board is the only video option Televideo lists, so it's not an easy workaround.

The documentation that was shipped with the Tele386e for review arrived in prerelease format as a packet of galley proof pages. If the printed manual retains the content of its galleys, it should prove helpful to the owner with a modicum of personal computing experience, but may be a less helpful guide for inexperienced users.

Televideo backs the Tele386e for one-year on parts, labor, and on-site service; a plus for corporate or personal buyers. Despite a Class A FCC certification that relegates this machine to the office environment, the documentation describes it as a Class B device. Our assumption is that the Class B rating is pending from the FCC despite Televideo's failure to provide a certificate number to verify the upgrade. Even so, the relatively high price of the computer might intimidate potential home buyers.

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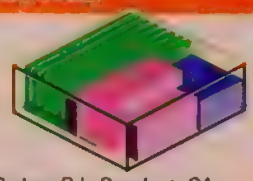


Televideo Tele386e
Televideo Systems Inc., 550 East Brokaw Rd., San Jose, CA 95161; (408) 954-8333.
List Price: With 4MB RAM, 1.2MB floppy disk drive, one parallel and two serial ports, DOS 4.01, $4,845; with 200MB hard disk, VGA display system, $7,609.
In Short: Good performance potential and Televideo's on-site service are major factors to consider, but the Tele386e's higher-than-average list price may offset the computer's advantages.

CIRCLE 630 ON READER SERVICE CARD

Tenex Computer Express

Tenex 386C-33 Power Column

by Bill O'Brien

When you get right down to it, there's really nothing remarkable about another 33-MHz 386 tower enclosure with 4MB of RAM, a 150MB hard disk, and a VGA display system. But discover a mail-order machine with a two-year warranty, the first year covered by on-site service, tie a $3,965 price tag to the package, and back it up with swift and solid computing performance and you can almost hear hands slapping wallet leather to get to the credit card number.

The Tenex 386C-33 Power Column closely resembles that of the Swan computer, with the same arrangement of three large front-mounted power, reset, and turbo mode buttons. Here, no distinction is made in the color of button to denote their function. As with the Swan enclosure, the legends on the case are sufficiently indiscernible at a distance to mandate some more visible marking to separate the turbo and reset buttons. The case holds five half-height drives, with three having front access capability. As tested, the Power Column holds both 1.2MB and 1.44MB floppy disk drives, as well as a Micropolis hard disk. Tenex opts for a 200-watt DTK power supply for this system, and adds a second cooling fan in the event you actually fill all of the drive bays.

FACT FILE

Tenex 386C-33 Power Column
Tenex Computer Express, 56800 Magnetic Dr., Mishawaka, IN 46545; (800) 776-6781, (219) 259-7051.
List Price: With 2MB RAM, 1.2MB and 1.44MB floppy disk drives, one parallel and two serial ports, DOS 4.01, $2,189; with 4MB RAM, VGA video display, 150MB ESDI hard drive and controller, $3,965.
In Short: Rock-steady performance and a relatively low price mark the Tenex 386 Power Column as an excellent choice that's backed with an FCC Class B rating and a two-year warranty.

CIRCLE 631 ON READER SERVICE CARD

The Power Column's eight-slot motherboard with 16-bit ISA bus comes from DTK, as is the system BIOS. This isn't a high-tech motherboard by any means. Discrete components are used almost exclusively, and they replace the more typical large scale circuits that would normally be employed as the 80386 chip

Tenex 386C-33 Power Column, $3,965

set and processor RAM cache controller. Nonetheless, the DTK motherboard offers plenty of computing prowess. Its performance among PC Labs' 80386 Instruction Mix, Floating-Point Calculation, and Conventional Memory tests give it a firm foothold within the top third of the machines reviewed.

The DTK board comes with 64K of 20-nanosecond cache RAM and can accommodate up to 8MB of on-board system memory expansion. Beyond that, Tenex can supply you with a $105 memory expansion board for the system's 32-bit proprietary slot and fill it at the rate of approximately $90 per megabyte up to the 16MB maximum limit.

A 15.30-second 150MB Micropolis hard disk came with the system and the notably slow results for DOS File Access are somewhat misleading as to the drive's actual performance capability. The ESDI controller, standard with this system, contains a 32K disk cache that was disabled for testing. With the cache in effect, expect a marked improvement in the drive's access performance.

Video performance is the caveat for this machine. The 16-bit generic VGA board with Trident chip set ran far below average, at 2.52 seconds, on the Direct to Screen test of the video hardware. However, the Video BIOS routine times were much more in line with the competition. It's quite probable that video BIOS shadowing gave the video card the needed boost in performance.

Tenex will not go down in history as a supplier of fine manuals. Four booklets are included with the system and they cover the motherboard, case, video card, and I/O board. Cardboard bound and three hole punched, experienced users will find them chock full of information about the technical setup of the various components, but novices who venture into mail-order purchases should make note of Tenex's phone support line.

Documentation aside, there are a number of support and service pluses from Tenex that make this system quite desirable. First and foremost is the company's 30-day free trial policy that lets you see the system in operation where you use it, how you use it. The company's two-year warranty is basically phone service with parts swapping should the problem be physical rather than procedural, but it doesn't hurt. And during the first year of the warranty, Tenex will even dispatch TRW to your site should the situation get out of hand.

Texas Micro Systems Inc.

Texas Micro Systems 3014

by Robert Kendall

Texas Micro Systems caters to laboratory and industrial uses with the 3014, its rack-mount 33-MHz 386. This rugged, heavy-duty system offers *PC Magazine*'s standard 64K RAM cache, 4MB of RAM, a 150MB hard disk, 1.44MB and 1.2MB floppy disk drives, and a Super VGA display for $8,515.

The 3014 is designed to be mounted horizontally on a rack with other equipment rather than positioned on a desktop

Texas Micro Systems 3014, $8,515

or the floor. It's also tailored to withstand the sort of wear and tear encountered in a lab or factory setting rather than an office environment. As testimony to this, a clear plastic door with a key lock covers the floppy disk drives to protect them from dust and a bracket fits over the expansion cards to keep them from popping out because of vibration. Two fans ensure adequate ventilation in hot conditions.

The unit sports 14 expansion slots to accommodate the most stringent telecommunication needs. On our test unit, two of these were 8-bit and the rest were 16-bit, but you can optionally replace the 8-bit slots with 16-bit ones. The 3014's 16-bit ISA bus is software switchable between 8.25 MHz and 11 MHz.

A CPU card takes the place of a mounted motherboard and holds the 80386 processor, the OPTI and Chips and Technologies chip set, an optional 80387 coprocessor, and all the system RAM. One serial and one parallel port are also mounted on the card, with a second serial port accessible through an optional cable and I/O bracket that take up a second slot. In the event of failure, replacement is as simple as pulling the CPU card and swapping it for another.

The CPU card will hold up to 16MB of 32-bit RAM, using 1MB SIMMs. It also sports a 64K 35-nanosecond RAM cache, which can be upgraded to 128K. A shadow RAM option available from the setup menu lets you relocate not only video and system BIOS, but also any BIOS on the bus.

Our test system came with a 150MB Control Data ESDI hard drive. The vendor offers various lower-capacity drive options ranging from 20MB to 104MB IDE configurations, but you'll have to go elsewhere for larger disks. The test unit included both 1.2MB and 1.44MB floppy disk drives, both mounted vertically.

Despite the 3014's industrial-strength capabilities in other areas and its substantial size, it has less drive bay capacity than many midrange desktop units. There's room for only two full-height drives and one 3.5-inch half-height drive, and the power supply offers only four device connectors.

The Texas Micro Systems 3014 targets a specialized market with its rugged rack-mount design and its plethora of expansion slots.

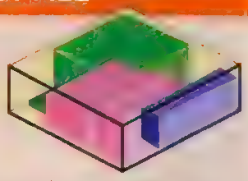
Texas Micro Systems provided its own 16-bit Super VGA card with 1024-by-768 resolution built around the Tseng Labs chip set with 1MB of onboard RAM. The card includes both a 15-pin and a 9-pin connector. The vendor also provided a Sony Super VGA monitor with the test machine.

The EECO 101-key enhanced keyboard has a firm feel but no tactile click or enlarged backspace key. It does provide extra key caps for reversing the positions of the Ctrl and Caps Lock keys.

Considering its hefty price tag, the 3014 turned in rather disappointing performances on our benchmark tests. It fell near the bottom of the heap on both the 80386 Instruction Mix and Floating-Point Calculation tests. Its scores on the Conventional Memory and disk speed tests were middling at best. Only on the video tests did it turn in above-average scores.

The Texas Micro Systems 3014 targets a specialized market with its rugged rack-mount design and its plethora of expansion slots. Users with a need for these particular features will find it a solid machine, despite its lackluster benchmark results. Some may find its mass storage limitations a problem, though.

FACT FILE



Texas Micro Systems 3014
Texas Micro Systems Inc., 10618 Rockley Rd., Houston, TX 77099; (800) 627-8700.
List Price: With 1MB RAM, 64K cache RAM, 1.2MB floppy disk drive, monochrome display, one parallel and one serial port, $5,169; with 1.2MB and 1.44MB floppy disk drives, 150MB ESDI hard disk, Super VGA display, one parallel and two serial ports, $8,515; with Weitek 3167, one serial and one parallel port, $9,280.
In Short: A rugged rack-mount unit intended for laboratory or industrial environments. Notable for its 14 expansion slots on a backplane and use of a CPU card instead of a motherboard, it offers middle-of-the-road performance.

CIRCLE 632 ON READER SERVICE CARD

Transource Computers

Verxion 386/33

by Rob Kendall

From the great southwest, land of 120-degree summer days, comes Transource Computers aiming to put a chill on hot and heavy pricing for 33-MHz 386 computing. This Phoenix-based company slaps a $3,699 midrange sticker on its Verxion 386/33. At this price, the Verxion conforms to *PC Magazine*'s standard 4MB of RAM, 64K RAM cache, 150MB hard disk, 1.2MB or 1.44MB floppy disk drives, two serial and one parallel ports, and a Super VGA display system configuration. It happens to be Transource's base system setup for this machine, also.

Those looking to strip off options to push the price of this unit down a few degrees will be disappointed. But at a price like this, who would want to? Here the only anomaly is that you can't buy DOS directly from Transource; you have to get it from Microsoft.

Transource houses the Verxion in a sturdy tower case with a top-carrying handle that provides easy access to the internal unit with removable back and side panels made of plastic and metal. Fold-out legs support the 386/33. Its interior design is clean, though the 80387 socket is partially covered by the hard disk. In addition, a full-length card seated in the number 1 slot restricts access to system board's jumpers. The motherboard-mounted serial and parallel ports leave five 16-bit and one 8-bit slots free in our standard configuration. As a bonus,

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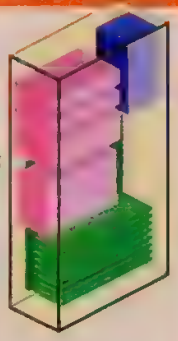

Verxion 386/33
Transource Computers, 2033 West North Lane, #18, Phoenix, AZ 85021; (800) 235-8101.
List Price: With 4MB RAM, 64K cache RAM, 1.2MB and 1.44MB floppy disk drives, 150MB ESDI drive, Super VGA display, one parallel and two serial ports, $3,699.
In Short: The Transource Verxion 386/33 is a worthy buy for its basic options, solid performance, expansion flexibility, and very attractive price. As a bonus, the Verxion will accept up to 40MB of 32-bit RAM.

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-PC Magazine, *386/25 Product Review*

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-InfoWorld, *Product Review*

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-Personal Computing, *10 Best Mail Order Companies*

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CIRCLE 368 ON READER SERVICE CARD

PCM 9-22A

Verxion 386/33, $3,699

there's even a PS/2 mouse port on the back of the unit, and the system will support up to four serial and two parallel ports. However, if you want to install extra ports, you'll have to disable those on the motherboard before adding I/O expansion boards. The 16-bit ISA bus speed is fixed at a slow 8 MHz.

RAM upgrades for the Verxion 386/33 require 1MB SIMM packages, which Transource makes available for an inexpensive $100 per megabyte of RAM. With room for 8MB of 80-ns. RAM on the motherboard, and two 32-bit expansion slots that will hold a maximum of 16 additional megabytes each, there's the opportunity to load the system with a whopping 40MB of usable RAM. Chances are you'll never need this much memory, so the 32-bit slots are more likely to used to hold standard 16-bit cards. The 25-ns. RAM cache can also be upgraded from 64K to 128K.

On PC Labs' benchmark tests, processor and memory scores place the Verxion 386/33 well in the middle of the pack. Tied to a Western Digital controller, the 150MB Seagate Technologies ESDI drive, with a 17.18-millisecond BIOS Disk Seek access time, was not an outstanding performer when compared with the competition. For those not satisfied with the unit's standard drive, Transource offers reasonably priced 300MB or 600MB ESDI or SCSI options, too. Since the chassis has room for three full-height drive bays, there's ample room for adding extra storage devices to suit your needs.

As for video performance, the Verxion's 16-bit MIT graphics adapter with Paradise chip set, and the swivel-mounted 13-inch Voltron monitor, support Super VGA resolutions. The display system scored well in the Video BIOS routines with times of 0.33 seconds in the without scrolling trials and 1.10 seconds in the with scrolling trials. Its Direct to Screen time of 2.03 seconds is about average for the systems tested.

On the tactile front, the machine's Monterey keyboard will satisfy users who prefer a light feel and a click in the key pads. The keyboard sports an enlarged backspace key and extra-large arrows on the cursor keys. Its only oddity is a blank, unimplemented macro key between the left Ctrl and Alt keys.

Overall, if you're in the market for solid performance and don't want to worry about too many option decisions, yet still need some expansion flexibility, the Transource Verxion 386/33 is an attractive purchase. For its price, this fully loaded unit beats the base price of a good many competitors.

Unisys Corp.

Unisys Personal Workstation Series 800/33A

by Rob Kendall

The Unisys Personal Workstation Series 800/33A carries an extraordinary price tag for an otherwise ordinary 33-MHz 80386-based machine. *PC Magazine*'s standard configuration, including 4MB of RAM, 64K RAM cache, 140MB SCSI hard disk, 1.44MB floppy disk drive, and color VGA display, will have the buyer laying out $9,970. Add a math coprocessor and your looking at $10,965. Even the manufacturer's $7,622 base system with monochrome VGA and no hard drive presents a formidable line item justification task on any budget.

Unisys Personal Workstation Series 800/33A, $9,970

For your money you get a tower case with room inside for eight expansion slots—one 8-bit, five 16-bit, and two 32-bit memory board slots that also can accommodate standard 16-bit cards. Power for the system is provided by a 303.5-watt unit with connections for five devices. The motherboard holds two serial and one parallel ports, leaving six slots free in the tested unit. Its 16-bit ISA bus is rated for 8 MHz and the processor speed can be switch selected down to 8 MHz from the keyboard.

On the motherboard, the 800/33A's standard 4MB worth of RAM can be expanded to 8MB using 1MB SIMM packages. In addition, an impressive system total of 24MB of usable 32-bit RAM can be reached using two optional memory boards holding up to 8MB of SIMMs each. You can't upgrade beyond the 64K of 25-nanosecond static RAM cache, though. The unit's video and BIOS relocation in RAM is available through the system setup menu.

PC Labs' DOS File Access tests and BIOS Disk Seek times rate the Unisys-labeled 140MB hard disk and its SCSI controller as bottom of the pack performers. Even ignoring the 23.32-millisecond BIOS Disk Seek, which doesn't accurately reflect the speed of SCSI devices, the disk scored the second slowest result, at 67.59 seconds, in the DOS File Access time for small records. The Unisys 800/33A did somewhat better with large records on the same test, but at 5.28 seconds, still remains too near the bottom of the charts to alter the negative impression.

There's room in the chassis for the standard two full-height and one half-

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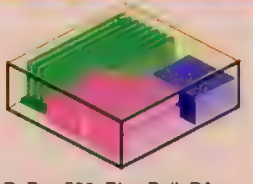

Unisys Personal Workstation Series 800/33A
Unisys Corp., P.O. Box 500, Blue Bell, PA 19424-0001; (800) 448-1424.
List Price: With 4MB RAM, 64K cache RAM, 1.44MB floppy disk drive, VGA monochrome display, $7,622; with 140MB SCSI drive, VGA color display, one parallel and two serial ports, $9,970; with 80387 math coprocessor, $10,965.
In Short: The Unisys Personal Workstation Series 800/33A's premium price and poor hard disk performance undercuts its competitive positioning as a versatile machine with power and quality options.

CIRCLE 634 ON READER SERVICE CARD

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height drive bays, and Unisys offers fairly standard SCSI hard disk options ranging from a $795 40MB unit to a $2,595 300MB drive. Other drive options from Unisys include a choice of a 1.44MB or 1.2MB floppy disk drive, and a $1,195 internal 135MB quarter-inch tape unit.

Video performance from the 16-bit Western Digital VGA card and a 13-inch Unisys Super VGA monitor showed a pronounced gap between the Direct to Screen test and the Video BIOS routines. A dismal 4.51-second time was recorded on the Direct to Screen test and above average times on the Video BIOS Without Scrolling and Video BIOS with Scrolling tests of 0.27- and 1.31-seconds were recorded, respectively.

Externally, the Personal Workstation 800/33A has a bit of an identity problem. Unisys markets the computer as a tower unit with the floppy drive bays, logo, LEDs, and power switch oriented vertically on the case. In every other way the unit follows the standard PC-AT horizontal desktop design from its rubber feet on the side to the manufacturer's separate plastic stand for tower mode. You even have to position the machine horizontally to remove the chassis. The Personal Workstations's 101-key enhanced keyboard has a solid feel and an exceptionally long 108-inch cable. For a price, there are other extras that can be had from Unisys including *Microsoft Windows* 3.0 bundled with DOS 4.01 for $195, and Microsoft Mouse for $99.

Unisys' Personal Workstation Series 800/33A has a Class B FCC certification and an on-site service option; despite its premium price, it has little to set it apart from the competition.

Wang Laboratories Inc.

Wang PC 350/33C

by Susan Langford Jones

Back in the 1980s, Wang was one of the progenitors of the Massachusetts Miracle, and like the commonwealth, the Lowell-based company now has fallen on lean times. However, lean is not a word that can be applied to the small-footprint Wang PC 350/33C's pricing. A fat $9,885 will buy a little microcomputing miracle matching *PC Magazine*'s standard configuration.

Stocked for testing with 4MB of RAM, 64K of 25-nanosecond RAM cache, a 200MB IDE hard disk, a 16-bit VGA display system, and two half-height floppy drives, the PC 350/33C's price tag crosses the five-figure mark, to $10,130. The good news is PC Labs' benchmark tests rate it a consistently able performer across the suite of tests. What's more, the PC 350/33C is a guaranteed platform for Wang's fine line of products, including its two-page display system, network cards, scanners, and hand and voice annotation devices. Customers doing image processing and computer-aided design will appreciate that all the peripherals they buy will be compatible and fully supported by a single manufacturer.

True to Wang's workstation roots, the system supports several operating systems (DOS, OS/2, Unix, Xenix, and SCO), but the company provides users with only system setup, diagnostics, and memory management software as standard features.

On the outside, the PC 350/33C is compact and stylish. Only its unique monitor swivel draws attention to the machine's physique. On the inside, a system board map, with switch setting guides, is the first thing you see.

The second thing you notice is that two of the eight expansion slots are tucked under the 145-watt power supply. Precious space is purchased at the price of expansion options. A 16-bit Video Seven VGA card and a Western Digital controller card, with two serial and one parallel I/O ports, leave only four usable slots open inside the chassis.

The Micronics motherboard holds 4MB of 80-nanosecond system RAM and sockets for an Intel 80387 or Weitek 3167 coprocessor. Wang offers a 32-bit add-in memory card filled with up to 12MB of 1MB or 256K SIMMs to bring the usable memory total to 16MB. BIOS functions are controlled with a Phoenix ROM and the system's 16-bit ISA bus is rated for 8 MHz. Video and system BIOS shadowing is handled by a hard switch on the motherboard.

Wang's IDE technology drive options range from a $500 20MB unit to $2,500 200MB drive. The 200MB Conner hard disk installed in this system proved itself to be an average performer in our tests, but its processor and memory times keep it competitive with the group. While Wang's 14-inch VGA system shines in the Video BIOS routines, its Direct to Screen times were average, at best. However, Wang offers an impressive listing of video system options.

SUPPORT STRENGTH

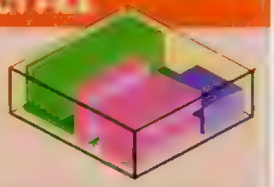
The real strength in this machine lies in its warranty, service, and support features.

Wang PC 350/33C, $9,885

The PC 350/33C is sold through dealers, value-added resellers, and directly from Wang. Service is available either through dealers, or at a worldwide network of Wang service centers. Technical support is available by telephone during extended business hours.

Given its Class A FCC certification, the machine will be living up to its character as a standalone all-purpose business machine or as a high-end design and graphics workstation. The Wang PC 350/33C is an expensive buy, even in its stripped down $5,810 version, but buyers get able performance, expandability with guaranteed compatibility, and sturdy construction. ■

PC FACT FILE



Wang PC 350/33C
Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; (800) 835-9264.
List Price: With 1MB RAM, 64K cache RAM, 1.2MB or 1.44MB floppy disk drive, Hercules monochrome display, one parallel and two serial ports, DOS 3.3, $5,810, with 4MB RAM, 200MB hard disk, VGA color display, DOS 4.01, $9,885; with two floppy disk drives, $10,130.
In Short: Excellent performance and solid construction make the Wang PC350/33C a reasonable, if somewhat expensive, choice. Thoughtful conveniences include a system board map placed on top of the drive bay rack, processor speed shifting via software, and a tool for popping out SIMMs.

CIRCLE 635 ON READER SERVICE CARD

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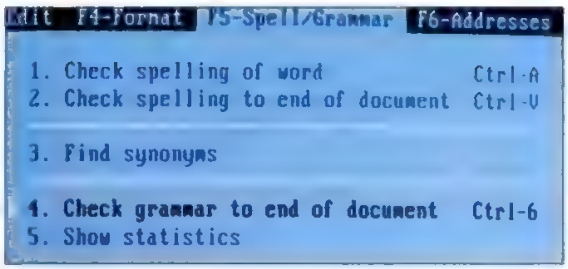
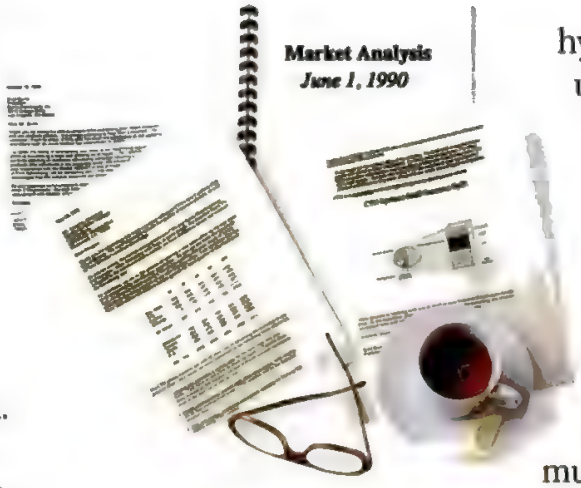


Check your grammar as easily as you check your spelling.

That's not all. Professional Write 2.2 has lots of other new features — automatic hyphenation, unlimited document size, enhanced import and export of delimited ASCII files, and much, much more. It's also available in Professional Write's new LAN version.



Greatly expanded printer and font support.

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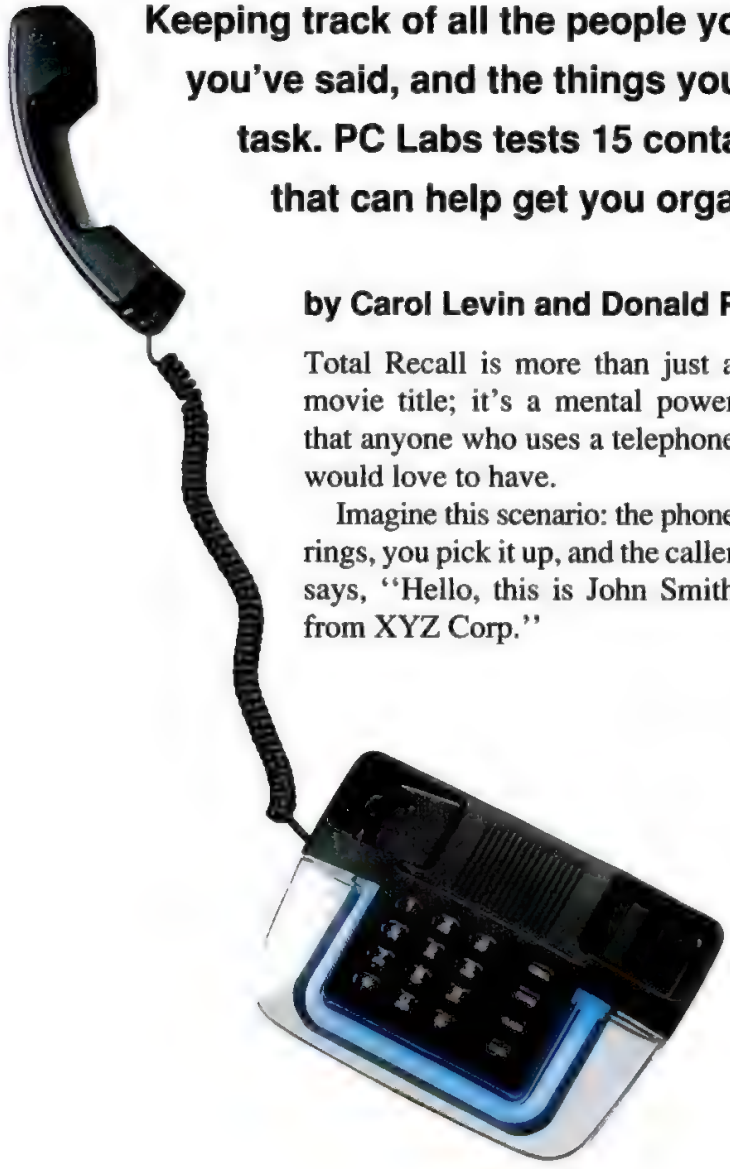
Total Recall

Contact Management Software

Keeping track of all the people you call, the things you've said, and the things you want to say is no small task. PC Labs tests 15 contact management packages that can help get you organized.



by Carol Levin and Donald P. Willmott

Total Recall is more than just a movie title; it's a mental power that anyone who uses a telephone would love to have.

Imagine this scenario: the phone rings, you pick it up, and the caller says, "Hello, this is John Smith from XYZ Corp."

Within seconds you remember every phone conversation you've ever had with Mr. Smith, his connection to your organization, his fax number, his account balance (if he's a client), and his wife's name. Smoothly, you respond, "Hi John. We haven't talked since you called about the Robinson project in August. I hope that letter I sent you on September 2 helped. By the way how's Barbara doing?" Needless to say, Mr. Smith is impressed.

PIMS WITH A PURPOSE

Contact management packages look (at first glance) like custom flat-file database applications. In fact, most of these packages are built from database languages, particularly *dBASE* and *Clipper*.

PHOTOGRAPH: PHOTOGRAPHIC AND FILM CREATIONS

Unlike the general-purpose personal information managers (PIMs) reviewed in the November 23, 1990, issue of *PC Magazine* ("Order From Chaos: PIMs Tackle Your Desktop"), the 15 contact managers evaluated here are designed specifically to keep records of all your phone calls and client contacts. Most present a screen filled with fields for contact names, numbers, addresses, and past conversations. Alarms and ticklers indicate when to make calls and what to say. Calendars, which add some PIM functionality, remind you of all the calls you need to make next Tuesday and keep track of your appointments as well.

Most packages can take the contact database and use it to print envelopes, generate mailing labels, and produce form letters. If a fax board is present in your PC or on your LAN, you may be able to send a fax from your desk. Desktop utilities like calculators, clocks, and expense trackers are also typically included.

FORM, FIT, AND FUNCTION

While most of the contact managers evaluated here perform similar tasks such as auto-dialing, they are differentiated by the people who use them. Heavy-duty systems like *TeleMagic* are designed for organizations with intensive telemarketing operations. Typical features include data import and export capability, capacity for an unlimited number of records and databases, an abundant supply of predefined reports, quick shelling out to DOS to run other applications, a robust complement of PIM functionality, expense tracking, and customizing options. They are also available in network versions with password security.

Focused on the unique needs of telemarketing forces, both *TeleMagic* and the less-powerful *Eighty/20 Advanced* include a function for creating scripts to prompt telemarketers when delivering a sales pitch. This package also includes *AutoSwap* for shelling to DOS while the program resides in only 10K of RAM. Other systems, such as *KeepTraX*, provide easy exits to DOS, but without some kind of memory swapping the program continues to devour enough memory to render this function essentially useless.

Another distinct group of contact management users require a different feature set. The salesperson who relies heavily on a laptop would have little use for the depth of a high-end solution and may opt for a system with multipurpose breadth. This user works primarily, and independently, with contact management software and thus would prefer a more-basic, self-contained productivity tool—a contact organizer, phone log, appointment book, and word processor.

Here also, portability, which is the program's capability to fit its code on one floppy disk with space to spare for contact information, is an advantage. The sacrifices are usually inconsequential—the electronic manual may need to be removed—but essential functions, such as basic search, to-do list, client history, and automatic rollover of unmade telephone calls or missed appointments, are retained. For the salesperson on the road, a rigid input format and minimal customization options can be conveniences rather than shortcomings.

Other packages emphasize functions valuable across a variety of business environments. *Act!*, Version 2.0, now includes an upscale word processor and support for 300 printers. While *Integrated Sales Manager* has a bare feature set, it performs functions with admirable speed. As a general-use contact manager, *The Maximizer* allows for input of comprehensive contact information and custom searches.

Contact managers are, for the most part, priced similarly to personal information managers. The packages evaluated here range from $69.95 for the no-frills *Business Contacts and Information Manager* to $795 for the feature-rich *Pursuit*.

UP THE ORGANIZATION

It's important to consider wider solutions before you buy one of these packages. While nine of these packages have special network versions, and some provide multiple databases so several users can track contacts independently on one PC, there are more-sophisticated solutions that extend beyond the scope of this evaluation. Although these high-end, higher-cost vertical market applications are not as ubiquitous as contact management software, they are dedicated to providing custom solutions and are emerging as competition for information management.

For example, there is an entire category of software referred to as "sales-force automation." The leading package in this arena is SaleMaker Software's *SaleMaker Plus*, priced at $695 for a single user version, $2,495 for a five-user LAN version, and $995 for each additional, five-user node. SaleMaker Software emphasizes the advantages of corporate-wide contact-information sharing by suggesting scenarios in which field sales reps transmit their daily activities back to the

EDITORS CHOICE

- **Act!**
- **Sales Ally**

Act! handles contact management chores flawlessly. Though it's no speed demon, its new and improved Lookup facility pulls up contacts quickly. The Launch function lets you start the day with *Act!*, and then flip back and forth between other applications and *Act!* as you make or take calls. No other contact manager is as complete in data entry and searching as *Act!*. If the future of contact management lies in applications that aren't sales-specific, *Act!* could be the program that leads the category into the mainstream.

Sales Ally is actually stronger than *Act!* in terms of data import. *Sales Ally*'s word processing facilities are also better, and its groupware functionality is a plus. The seamless move between single and multiuser versions is also an attractive value.

An honorable mention goes to *The Maximizer*. It isn't as slick as *Act!*, but it's got great speed, and its list manipulation is outstanding. Watch for the upcoming Version 3.0.

TeleMagic manages the difficult trick of balancing ease-of-use for beginners and advanced users, while also providing a depth of features that is hard to outgrow. As shipped, you'll find a well-thought out package that offers all of the basics and includes the freedom to redefine the 22 fields on the contact record and add 78 more fields, rewrite the help screens, and call on text files to create a library of on-line information.

Finally, *Instant-Office* gets an honorable mention for the clever way it incorporates your own word processor. If you can live with its quirks and limitations, it will serve you well.

company LAN each night and get whatever reports they need from the corporate-wide database.

SaleMaker Software also sells a corporate development system for MIS staffs who want to customize the software. The company will also do customized software for organizations with special needs.

REAL WORLD SOLUTIONS

You can also find contact management software with links to familiar accounting packages. RealWorld Corp.'s *RealWorld Sales Management Solutions* is a good example. This package can be purchased for $695, but its likely that most people will opt for the $1,995 network version. *SMS* has most of the features you'd expect in a contact management package, but it also allows sales managers to monitor income due, income received, and revenue. The package's interface matches that of the *RealWorld Accounting Series*, and it ties into RealWorld's inventory, order-entry, accounts receivable, invoicing, and job costs modules.

Because of its tight integration to the *RealWorld Accounting Series*, we don't evaluate the package here with the single-user contact managers. Its excellent connections to the accounting software make it unwieldy and hard to recommend as a standalone solution when so many low-overhead, easy-to-use alternatives are available. As part of a complete, front-to-back sales force automation system, however, *SMS* is a great addition to the widely used *RealWorld Accounting Series*.

Another approach is taken by SBT Corp., which is best known for its *dBASE*-based accounting software. SBT offers *Corporate Contact Manager*, an organization-wide contact manager that tracks all incoming and outgoing calls and their duration, and then connects all sales activity related to the calls directly to SBT accounting software. This $1,395 package generates call lists based on sales information taken from accounts receivable and sales order files, and if a fax server is available, users can send faxes directly from their PCs.

FUTURE SHOCK

As communications technology improves, contact managers are destined to become even simpler to use. You may wonder, for example, how far away we are from systems that can identify the person calling and bring up the appropriate sales record before you even answer the phone. Caller ID technology, also known as automatic number identification (ANI), which is now available in a few states (in some cases it is facing legal opposition on the grounds of privacy rights violation), would seem to make this easy to do, but there are obstacles.

First, the concept is worthwhile only for organizations like mail-order firms that handle mostly inbound calls. If you sell by making calls yourself, there's no point. Second, you face the problem of having your incoming calls identified by the PBX system of the company your client is calling from, not by his or her personal extension. And until MCI and AT&T settle on some standards, Caller ID cannot make great leaps forward, even if the ISDN technology that makes it all possible proliferates quickly.

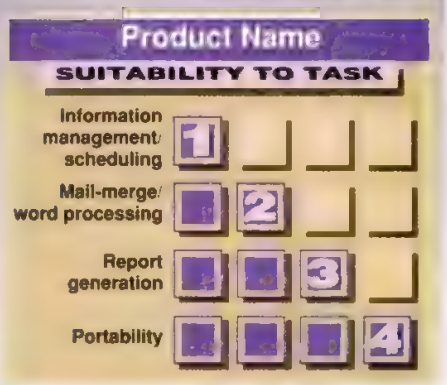
For the time being, you still need to pick up the phone to make and answer your calls, and if you do that with any frequency, a good contact manager will serve as the steel-trap memory you wish you always had.

REVIEW CRITERIA

The 15 contact management packages included in this round-up are evaluated as standalone packages designed for the individual salesperson; we will review sales-force automation packages like *SaleMaker Plus* and RealWorld's *Sales Management Software* in an upcoming issue. Although it was not required for evaluation, most of the packages can be run from one or two floppy disks, making them viable for those who take floppy disk-based portables on the road.

CONTACT MANAGEMENT SOFTWARE: SUITABILITY TO TASK

PC Magazine has assessed and assigned a point value to each contact manager's suitability for four tasks: general PIM use, word processing/mail-merge, report generation, and portability. These subjective ratings, based on a scale from 0 to 4, are presented along with each review.



THE TASKS

Information management/scheduling refers to the package's name and address management, phone-dialing capabilities, and scheduling/tickler/to-do-list features.

Ratings for **Mail-merge/word processing** reflect the package's letter generation capabilities, word processing features (or easy access to outside facilities), list extraction features, and control over nonaddress fields.

Report generation covers the package's ability to print (to disk and paper) phone books, schedules, calendars, to-do lists, and free-form reports.

Portability is an important issue both for traveling salespeople and for anyone who already has contact information in some other format. A package scores well if it fits onto a 760K floppy disk with 500 contacts included, has good facilities for updating desktop and floppy disk-based files, has the ability to share a larger database with others, and has easy import and export capabilities.

THE RATINGS

0–lacks feature or is not at all suited
1–poorly suited
2–some capability
3–well-suited
4–ideal for the task

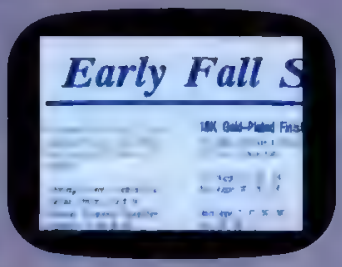
Act!

by Gregg Keizer

Emerging from a recent facelift with faster contact lookup, an impressive report generator, and the ability to schedule multiple calls, meetings, and appointments, Contact Software's *Act!*, Version 2.0, gracefully walks the wire between contact management simplicity and performance. The $395 program foretells the future of contact management software. Not only is it slick, full-featured, and economical in required keystrokes, it

IT'S OUR AGAINST

WordStar 6.0 vs. WordPerfect 5.1**



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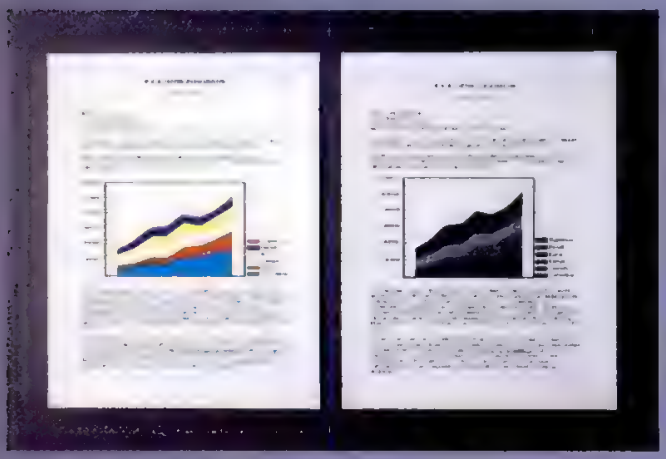
WordStar 6.0 vs. WordPerfect 5.1

WordStar comes with a Graphics Editor.

WordPerfect doesn't (it's an additional $495).

WordStar 6.0 vs. WordPerfect 5.1



We print color graphics, they don't.

WordStar 6.0 vs. WordPerfect 5.1

WordStar includes Telecommunications. WordPerfect doesn't.

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WORD THEIRS.

WordStar 6.0 vs. WordPerfect 5.1

Page preview: 144 pages vs. 2 pages.*

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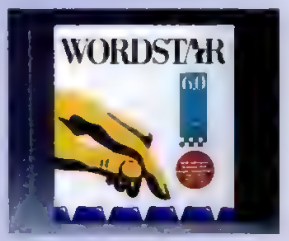
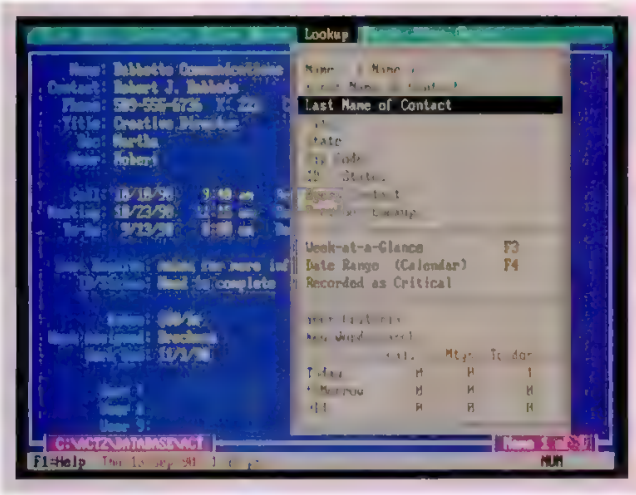


CIRCLE 510 ON READER SERVICE CARD

enables you to shell to DOS or launch another program while holding only 10K captive. This ability actually encourages you to jump from *Act!* to another application and back throughout the day.

Act! 2.0 abandons the Lotus-style primary/secondary menu system of its predecessor and debuts an easier-to-use single menu bar with pull-down options. Though the program now supports a mouse, the keyboard controls are still preferable. One reason is that you can set tab stops on any field for quick, keyboard-controlled shifts around the screen. *Act!*'s database displays 73 fields on two well-designed screens for each contact.



Act!'s Lookup search function is fast and flexible, and marks one of the major improvements in Version 2.0.

UNLIMITED CALLS

Menu selection, data entry, and general navigation are all excellent. Pop-up submenus abound, with more than half of the fields linked to pop-ups that hold common responses. You can customize nearly all the submenus to speed up data entry. In most cases, manipulating *Act!* becomes second nature quickly, even with extensive use of function-key combinations.

Act! integrates several important tools with its contact database. The package includes a simple word processor with spell checker, calendar, to-do list, contact note writer, contact summary, weekly scheduler, and expense recorder. All features are linked with the contact file and can handle many repetitive chores, such as automatically inserting the contact's name and address in a letter's salutation. You can schedule an unlimited number of future calls or meetings, or list an unlimited number of tasks for each contact. That's a major improvement over earlier versions.

Telephone-related support is solid, and a timer to record the duration of calls can be switched on and off for your billing purposes. All calls, incoming or outgoing, are logged to the contact's activity file. You can utilize nine predefined reports or design almost any kind of custom report with *Act!*'s powerful and complex report generator.

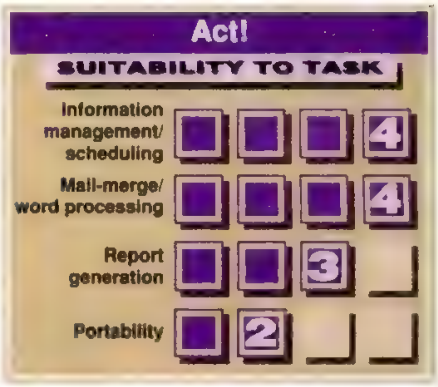
Contact Software has added an impressive list of features to Version 2.0, yet it lacks password security and doesn't spot duplicate entries. The task list includes calls, meetings, and to-do tasks, but would be even more valuable if you could prioritize uncompleted tasks or automatically roll them over to the next day. While the pop-up submenus make contact information entry fast, there's no way to copy all, or even some, of your entry to another entry in your client files.

FACT FILE
EDITOR'S CHOICE

***Act!*, Version 2.0**
Contact Software International Inc., 1625 W. Crosby Rd., #132, Carrollton, TX 75006; (214) 418-1866.
List Price: $395; upgrade from 1.1, $69.95.
Requires: 640K RAM, hard disk, DOS 3.0 or later.

In Short: *Act!* is a powerful, yet easy-to-use program that's better equipped to handle nonsales contact management tasks than any other program. A significant upgrade to an already solid program, it can now locate a contact much faster and schedule an unlimited number of future calls, meetings, and tasks for each contact.

CIRCLE 398 ON READER SERVICE CARD



ONE TO BEAT

Few contact managers come close to *Act!*'s depth or breadth. You can boot *Act!* at 8:00 A.M. and remain within it until 5:00 P.M., all the while handling calls, writing letters, and taking notes. When you need your spreadsheet or full-featured word processor, you can easily drop out of *Act!* and return to it quickly. Its database search, though much improved and considerably faster and more efficient than before, still doesn't match *The Maximizer*'s speed. *Act!* is an excellent contact manager both for sales and nonsales use, but it lacks the telemarketing features that phone-intensive salespeople may require.

Nevertheless, the jump to Version 2.0 puts *Act!* ahead of most of the competition. *Act!* is one of the most powerful general contact managers available—in great part due to its generous feature list and minimal keystrokes required for most tasks. *Act!* works better in a nonsales capacity than any other contact manager, and therefore has the best potential to help push contact management farther into the software mainstream.

Action Plus

by Emerson A. Torgan

With the ability to attach up to 50 different graphic images to each one of its detailed contact screens, Action Plus Software's *Action Plus*, Version 4.02, is a unique contact manager. The $495 package is at its most impressive when running on a desktop PC, but it will run on a laptop if you sacrifice the on-line help, the on-line users manual, and the satellite module that allows tranfer of records from one *Action Plus* system to another. Attaching anything that can be scanned and/or saved as a .PCX file to a contact record gives the telemarketer the ability to see and de-

FACT FILE

***Action Plus*, Version 4.02**
Action Plus Software, 11485 South High Mountain Dr., Salt Lake City, UT 84092; (801) 572-3303.
List Price: $495; network version, $1,495.
Requires: 640K RAM, hard disk, DOS 3.3 or later
In Short: *Action Plus* offers detailed contact informaton and versatile search features that can be as simple or complex as the situation dictates. The unique ability of the package to attach graphic images to a profile and display them on screen seperates *Action Plus* from the rest of the pack.

CIRCLE **399** ON READER SERVICE CARD

scribe the items in inventory.

If you have the discipline to update the many detailed and date-oriented fields of each contact record, you will be rewarded with a clear and concise report of any transaction, contractual agreement, phone call, or letter that may have transpired. By utilizing specific entries, such as ID numbers and a code space with which you could tag profiles specifically as "Widgets" or "California," you can minimize the time needed to search through your database. Another helpful feature is the space for contact gender, especially useful when you deal with unisex names like Terry or Pat.

The screens are packed with information relating to your contact: name, company, address, position, first and last dates of communication, notes, sales commission and contract status, ID numbers, tax ID, code, and phone number entries that can be customized up to ten digits. At first it seems a bit overwhelming to have so much on screen at once, but any salesperson will value the comprehensiveness.

Functions such as Add, Delete, Find, and List are executed with first-letter keystrokes, function keys, or cursor placement.

SEARCHING WITH SPEED

When speed is essential, *Action Plus* offers two ways to pull up a profile: Quick Search, which lets you search only by last name or company, or Complex Search, which opens a blank contact record and lets you fill in as much criteria as you want. The more specific you are, the quicker you'll find the desired record.

The calendar functions as a daily planner and accepts entries as appointments or to-do tasks. Meetings are displayed graphically as a bar that extends over a fixed time line running from 7 A.M. to 8 P.M. across the bottom of the screen. When attempting to schedule conflicting or overlapping meetings, *Action Plus* warns you and will accept the conflict, changing the color of a portion of the bar to illustrate the length of each meeting.

***Action Plus*'s thorough main data-entry screen has a spot for just about every piece of contact information. At the bottom of the screen are two rows of menus—the top row is activated by function keys and the bottom row by positioning the cursor or typing the first letter.**

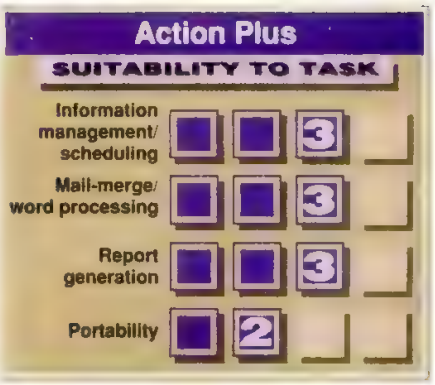
The expense report feature is another convenience for the salesperson on the move. Odometer readings can be calculated within this field at an adjustable expense rate, and total billable hours to a client can be added up and printed with the appropriate names and dates.

WHAT'S MISSING?

With five viewing fields, a free-form notepad, a calendar, 20 different telemarketing scripts and form letters, invoices and report generators, expense and appointment records, and the ability to log 99 million profiles and 1 billion items in inventory, *Action Plus* is fairly complete. But it is by no means perfect.

The package is a memory hog, rendering the exit-to-DOS function basically useless. *Action Plus* is not a TSR, so when the phone rings you need to load it in order to view the appropriate profile. It also lacks a calculator.

The advantages of *Action Plus* center around its detailed contact records and its ability to attach images. Like other contact managers, it requires a commitment from you to update the database. Although what is sacrificed through commitment is returned in speed—when speed really counts.



Biz*Base Gold

by Alfred Poor

A basic part of microcomputer software lore is the story of the end user who developed a program that others wanted to use, so the author published it and sold lots of copies. *Biz*Base Gold* is an example of this "kitchen table" software success story. With a list price of $175 and a complete list of features, the program from Creagh Computer Systems looks

like an attractive value. Unfortunately, its apparent strengths do not hold up to closer scrutiny.

Developed from *Clipper* and other *dBASE*-related tools, *Biz*Base Gold* shows many tell-tale signs of evolutionary growth and inconsistent execution of design strategy.

THE LOOK AND FEEL

The character-based text screens are attractive, and the color choices for displays are reasonable. You can alter the heading for just about every field, giving you the flexibility to alter the appearance of the stored data. There are seven character fields, six date fields, six numeric fields, and six logical fields that are intended for user-definable information and provide plenty of flexibility. Since you can define additional indexes for database searching and reporting, you have added flexibility.

There is also context-sensitive on-line help. If the program is unable to decipher the information you need, it presents a windowed index of help topics and you can choose the one you want. Here is where the frayed edges start to appear. The help screens are limited in content, and some topics, such as printer setup strings, are missing entirely. Some help screens only provide a sales pitch for other products from the publisher, such as the collection of canned mail-merge letters. (The sample mail-merge letters provided with the program start with a header that spells out the deal as well.)

THE CHALLENGES

Turn to the manual for support, and you are thwarted again. The index does not provide entries for fundamental items such as "Printer" or "Envelopes." The manual is primarily a loose mixture of tutorial and reference. There are typos, words that run together without spaces, and the useful information in the documentation is often difficult to find.

The user interface provides additional challenges. There are many function keys active at a given time, but only some are listed at the bottom of the screen. Some assignments are not intuitive; to create a letter for the record on screen, you don't select "Correspondence," but instead use "Forms." A function-key template and a pop-up reference window help you remember the assignments, but you'll need the manual to keep track of the options. And when you use the Escape key to back out of an operation, you are often returned back to the top level rather than the prior step. This means a lot of repeated work when you select the wrong report or label format, and getting dumped back to the program's opening screen.

There is no built-in support for printers. Instead, you are directed to study your printer manual so you can enter the correct Escape sequences. This is all well and good, but it means that the program's word processor won't space your 10-point Times Roman laser font correctly.

One bright point, however, is data import. Provided that you have your data in a *dBASE*-compatible format, you can assign fields one by one to match up with the corresponding *Biz*Base* format. On the other hand, if you only have a comma-delimited or fixed-length format, the data must match the *Biz*Base* format precisely. Unfortunately, the manual does not entirely explain the complexities of this task.

HELP ON THE WAY

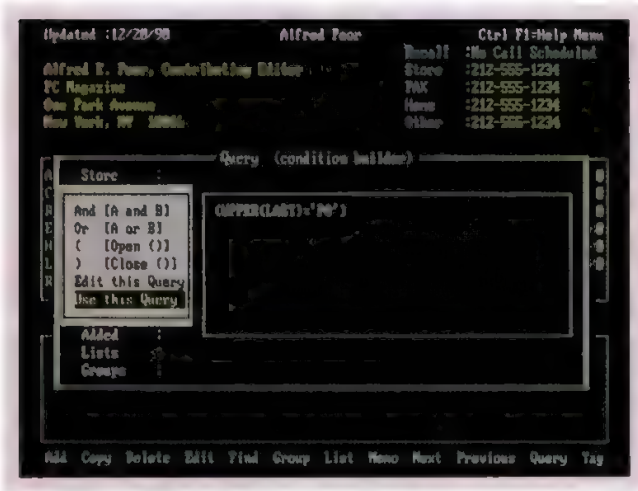
According to a company representative, Creagh Computer Systems was a month away from releasing Version 2 of *Biz*Base* at the time of this review. The new version is reportedly a complete overhaul of Version 1.1, with more features, new file structures, and new documentation.

The version of *Biz*Base Gold* tested here has some sophisticated scheduling and to-do list features and offers suitable extras, such as a pop-up calculator, spell checking, time and date stamping, and alarms. If there were no other programs available in this category, it would be a treasure because you certainly can do a lot of useful work with it. The problem is that it is so uneven and is missing so many important features that it does not hold up in comparison with the competition.

FACT FILE

***Biz*Base Gold*, Version 1.1**
Creagh Computer Systems Inc., 674 Via de la Valle, #204, Solana Beach, CA 92075; (800) 833-8892, (619) 792-1367.
List Price: $175; four-user version, $600; additional four-user modules, $400.
Requires: 640K RAM, DOS 3.0 or later, hard disk.
In Short: *Biz*Base Gold* has evolved from one man's tool to a full-fledged general purpose product, but this evolutionary growth has left some holes and rough edges that make the package far less attractive than some of its more polished competitors.

CIRCLE **400** ON READER SERVICE CARD



***Biz*Base Gold* offers a straightforward "Find" feature as well as a more-complex query function. You can build queries using any field and menu-driven selections. When a phrase of the query is complete, the program shows it in the box to the right.**

Business Contacts and Information Manager

by Carol Levin

For the uninitiated user of contact management software, functional simplicity is a strong advantage and one that's the core of *Business Contacts and Information Manager*, Version 1.1, sold by Disk-Count Software for $69.95. Yes, $69.95.

The price you pay for ease of use is limited options and some awkward compromises that more-robust and costly packages overcome. *BCIM* is not an

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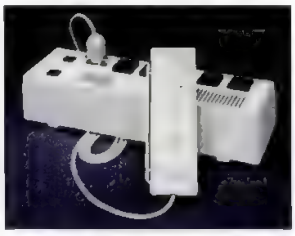

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***Business Contacts and Information Manager*, Version 1.1**
Disk-Count Software Inc., 1751 West County Rd. B, #107, St. Paul, MN 55113; (612) 633-2300.
List Price: $69.95.
Requires: 512K RAM, DOS 2.0 or later.
In Short: *BCIM* can help you communicate more effectively with your clients with a minimum of effort. If you don't need any fancy phone work or relish the thought of wrestling with contact management software, the no-frills *BCIM* could work for you.

CIRCLE 401 ON READER SERVICE CARD

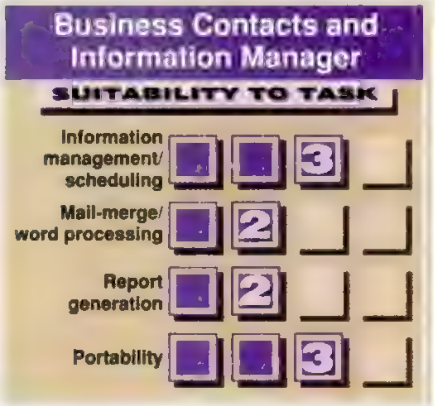
ambitious package, yet should satisfy the expectations of the entry-level user and buyers resisting steep prices.

As a modified knockoff of Eighty/20 Software's *Expeed*, *BCIM* users receive an attractive upgrade policy to Eighty/20's line of contact managers. You can convert your data automatically to these more-powerful packages, which include expense tracking, statistical data, multiple databases, and data import and export. *BCIM*'s built-in obsolescence positions Eighty/20 products in Disk-Count Software's wide retail distribution stream.

BCIM can do essentially what other contact managers do—replace your Rolodex, to-do list, calendar, and even function as a simple personal information manager. Version 1.1 condenses the program's code from three to one floppy disk for easy installation on a laptop, enabling you to tote your office everywhere. The Start-Up Guide takes you step-by-step through *BCIM* using a dummy list of contacts, memos, and letters, so you probably won't need to print the 100-page manual that's supplied only on disk.

SIMPLE SCREENS

The screen architecture is only a few levels deep with four main-menu choices: Daily Schedule Update, Client Access Menu, Maintenance Menu, and Report Menu. The bottom row of 15 selections quickly allows you to edit, print, display a schedule, or type a letter. A handful of hot keys access context-sensitive help, a notepad, and monthly calendar. Most daily work is oriented around the Client Profile screen—a screen that accesses every bit of information you've stored about clients, including company and contact name, address, phone numbers, and notes, as well as ten user-defined descriptors. You can conveniently add contact names to a company already on the system without retyping repetitive information.



The rather rigid design of the Client Profile screen prohibits city names longer than 15 characters, and the ZIP code format can't be modified for Canadian codes, such as M4V 2Z5. There is space for two 10-digit telephone numbers, but you can't identify them with specific labels indicating fax, extension, or e-mail.

From the Client Access menu you can launch searches as well as edit, shuffle, and sort your stack of Rolodex cards. There's also an auto-dialer, mail-merge facilities, a skeletal word processor, an assortment of customizable business letters, and ten generic reports that offer a moderate customization. For a low-end package, the printing formats are sufficient, including 2-by 4-inch and 3- by 5-inch Rolodex cards, 1- and 2-column formats, envelopes, and labels.

One of the more-convenient viewing features is the Daily Update of Schedule Dates, which reminds you of all the phone calls, meetings, and letters you've neglected. You can also view a schedule for each client; a group of clients by filter; a monthly calendar; a daily schedule; and a history of each client.

There are ten customizable descriptors that use three-letter abbreviations to further identify clients and two search methods. Using the "By Example" approach, you identify specific criteria and send the system on a search of all clients that match the filter. The "By Sub-Group" approach saves filters and expedites tasks such as printing and reporting.

THE FUNCTIONALITY TRADE-OFF

One particularly irksome limitation forces you to attach all appointments to a particular client. To schedule a holiday, you must first enter it on a Client Profile screen. The date will then be posted directly to the monthly calendar, and the holiday will appear in your list of clients, a rather compromising solution.

Other limitations are: a monthly calendar that fits only two lines of ten characters per day. There is no warning that you've scheduled conflicting meetings, so you can plan two or more meetings that start at the same time. You're also restricted to one database, which prohibits extensive customization. One final tradeoff is *BCIM*'s lack of integration. There are three locations to jot a memo of any length, but you may forget exactly where you stored it. Lacking text retrieval capability, the system leaves you to hunt down the memo yourself.

With a rock bottom price tag, *BCIM* is a back-to-basics package that provides just enough power to turn an unruly list of

Using the "By Example" search with two filters—architecture firms and Eastern territory—this *Business Contacts and Information Manager* search displays its first hit. From here, you can auto-dial this customer, flip to the next client rounded up in this search, or select a letter to send.

PCs beat Macs for Illustration

REPORT CARD

AUGUST 20, 1990

INFO WORLD

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	InfoWorld weighting	(Your weighting)	PC: Adobe Illustrator Version 1.0	PC: Arts & Letters Graphics Editor Version 3.0	PC: Corel Draw Version 1.2.1	PC: Micrografx Designer Version 3.0.1	MACINTOSH: Adobe Illustrator Version 1.9.5	MACINTOSH: Aldus Freehand Version 2.0.2	MACINTOSH: CA-Cricket Draw Version 1.1.1	MACINTOSH: Canvas Version 2.1
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Performance										
Drawing/editing	(150)	( )	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Satisfactory	Good
Tracing	(50)	( )	Very Good	Very Good	Very Good	Excellent	Very Good	Satisfactory	Poor	Good
Import/export	(50)	( )	Satisfactory	Satisfactory	Very Good	Very Good	Good	Good	Satisfactory	Very Good
Speed	(50)	( )	Satisfactory	Very Good	Excellent	Good	Excellent	Satisfactory	Good	Good
Output quality	(100)	( )	Good	Good	Excellent	Very Good	Excellent	Very Good	Satisfactory	Satisfactory
Documentation	(100)	( )	Very Good	Good	Very Good	Excellent	Very Good	Good	Satisfactory	Satisfactory
Ease of learning	(100)	( )	Very Good	Good	Excellent	Very Good	Satisfactory	Good	Very Good	Good
Ease of use	(125)	( )	Satisfactory	Very Good	Very Good	Very Good	Satisfactory	Very Good	Satisfactory	Very Good
Error handling	(75)	( )	Good	Poor	Good	Good	Good	Very Good	Good	Very Good
Support										
Support policies	(50)	( )	Satisfactory	Good	Good	Very Good	Satisfactory	Satisfactory	Satisfactory	Good
Technical support	(50)	( )	Satisfactory	Very Good	Very Good	Very Good	Good	Good	Very Good	Very Good
Value	(100)	( )	Satisfactory	Good	Excellent	Very Good	Very Good	Very Good	Satisfactory	Very Good
Final scores			**6.0**	**6.4**	**8.2**	**7.7**	**6.9**	**6.8**	**5.4**	**6.5**
Use your own weightings to calculate your score										

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Satisfactory = 0.5 — Meets essential criteria
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120MB 1:1 Interleave	$4295	$4345	$4445	$4595	$4645	$4695	$4795
160MB 1:1 Interleave	$4695	$4745	$4845	$4995	$5045	$5095	$5195
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65MB - 1:1 Interleave	$1845	$1895	$1995	$2145	$2195	$2245	$2345
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120MB 1:1 Interleave	$2245	$2295	$2395	$2545	$2595	$2645	$2745
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And everyone knows (800) calls are costly. So when MicroLab decided to offer NATIONAL TOLL FREE technical support, some people thought us either gluttons for expense...or confident our customers wouldn't have to use it too often

We like to think we're just confident

30 Day Money Back Guarantee

Your complete satisfaction is at the heart of every system we build

So purchase your system with complete confidence Put it through its paces. Kick the tires for 30 days

If dissatisfied, simply contact us to initiate its expedient return and a prompt refund on the hardware price

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Iron Clad Warranty

MicroLab computers are rugged, solid performers built for compatibility and reliability

We stand behind every system manufactured with a comprehensive 1 Year Limited Warranty on all required parts and labor

Additionally, MicroLab offers its popular S.W.A.P (Supplemental Warranty Assurance Program) Extended Warranty Policy for additional warranty protection at a nominal price

Be sure to ask your consultant for details

MicroLab's Commitment

MicroLab is a wholly owned subsidiary of the National Microcomputer Research Institute, an organization dedicated to the advancement of microcomputer technology

We've evolved into a preferred vendor for government, educational and corporate institutions alike

We'd like nothing more than to be yours, too

It's As Easy As Calling 1-800-677-7900

Whether you've got your eye on a pre-configured MicroLab system or need assistance configuring one, call us today

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MICROLAB™ 386/SX-16 & 386/SX-20

- 2MB RAM-expandable to 8 MB
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- 65MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
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- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

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MICROLAB 386 SX-16 Price Matrix	Mono Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB 1:1 Interleave	$1345	$1395	$1495	$1645	$1695	$1745	$1845
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65MB 1:1 Interleave	$1495	$1545	$1845	$1795	$1845	$1895	$1995
80MB 1:1 Interleave	$1795	$1845	$1945	$2095	$2145	$2195	$2295
120MB 1:1 Interleave	$1895	$1945	$2045	$2195	$2245	$2295	$2395
160MB 1:1 Interleave	$2295	$2345	$2445	$2595	$2645	$2695	$2795
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386 Performance with 286 Compatibility!

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MS-DOS®, UNIX®, OS/2® & Novell® Compatible
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65MB 1:1 Interleave	$1145	$1195	$1295	$1445	$1495	$1545	$1645
80MB 1:1 Interleave	$1445	$1495	$1595	$1745	$1795	$1845	$1945
120MB 1:1 Interleave	$1545	$1595	$1695	$1845	$1895	$1945	$2045
160MB 1:1 Interleave	$1945	$1995	$2095	$2245	$2295	$2345	$2445
320MB 1:1 Interleave	$2545	$2595	$2695	$2845	$2895	$2945	$3045

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- Monochrome Video Adaptor
- Serial, Parallel & Game Ports
- 101 Key Tactile Switch Keyboard
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Video Options — Include Monitor & Video Card

MICROLAB XT/12 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14 640x480	VGA Multi 14 800x600	VGA Hi-Res 14 1024x768
30MB 1:1 Hard Disk	$ 745	$ 795	$ 895	$1045	$1095	$1145	$1245
40MB 1:1 Hard Disk	$ 895	$ 845	$ 945	$1095	$1145	$1195	$1295
65MB 1:1 Hard Disk	$ 895	$ 845	$1045	$1195	$1245	$1295	$1395
80MB 1:1 Hard Disk	$1195	$1245	$1345	$1495	$1545	$1595	$1695
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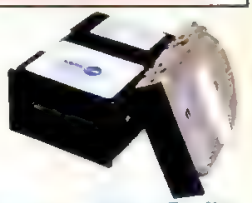
Name Brand Products. Rock Bot

Hard Disk MicroKits

Seagate
K/LOK



5.25" Hard Drives

	Drive Only	AT Kit	XT Kit
Seagate ST225 *20MB, 65ms, MFM, HH*	178	183	223
Seagate ST238R *30MB, 65ms, RLL, HH*	195	200	243
Seagate ST250R *40MB, 68ms, RLL, HH*	199	204	249
Seagate ST251-1 *40MB, 28ms, MFM, HH*	269	274	315
Seagate ST277R-1 *65MB, 28ms, RLL, HH*	299	304	339
Seagate ST296N *80MB, 28ms, SCSI, HH*	399	404	449
Seagate ST4096 *80MB, 28ms, MFM, FH*	517	522	557
Seagate ST4144R *120MB, 28ms, RLL, FH*	569	574	609
Seagate/Imprimis ST4182E *160MB, 17ms, ESDI, FH*	949	INQUIRE	
Seagate/Imprimis ST4182N *155MB, 17ms, SCSI, FH*	979	INQUIRE	
Seagate/Imprimis ST435ON *307MB, 18ms, SCSI, FH*	1399	INQUIRE	
Seagate/Imprimis ST4384E *329MB, 15ms, ESDI, FH*	1599	INQUIRE	
Seagate/Imprimis ST2383E *337MB, 16ms, ESDI, HH*	1599	INQUIRE	
Seagate/Imprimis ST2383N *338MB, 16ms, SCSI, HH*	1629	INQUIRE	
Seagate/Imprimis ST4766E *676MB, 16ms, ESDI, FH*	2099	INQUIRE	
Seagate/Imprimis ST4766N *676MB, 16ms, SCSI, FH*	2149	INQUIRE	
Seagate/Imprimis ST41200N *1050MB, 17ms, SCSI, FH*	3899	INQUIRE	

3.50" Hard Drives

	Drive Only	AT Kit	XT Kit
K/Lok KL320 *20MB, 40ms, MFM, HH*	169	174	215
K/Lok KL330 *30MB, 40ms, RLL, HH*	179	184	229
Seagate ST138R *30MB, 40ms, RLL, HH*	249	254	295
Seagate ST157R *50MB, 40ms, RLL, HH*	275	279	319
Seagate Imprimis ST1100 *88MB, 15ms, MFM, HH*	649	654	697
Seagate Imprimis ST1162N *142MB, 15ms, SCSI, HH*	779	INQUIRE	
Seagate Imprimis ST1201E *177MB 15ms, ESDI HH*	1029	INQUIRE	
Seagate Imprimis ST1201N *177MB, 15ms, SCSI, HH*	1049	INQUIRE	

MicroLab MicroKits Include:

- Hard Disk Drive
- Dual Drive Controller for XT Kits
- Mounting Hardware
- Bezel & Cabling
- Disk Manager Software for Drives 40MB and Up
- Comprehensive Installation Manual

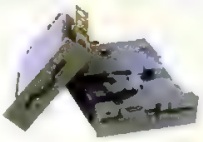
MicroLab Hard Cards

	8 Bit	Tandy	SCSI	16 Bit
Hard Card/20 *20MB, 40ms*	245	265	339	359
Hard Card/30 *30MB, 40ms*	269	289	359	375
Hard Card/50 *50MB, 40ms*	349	369	439	539
Hard Card/90 *88MB, 15ms*	699	719	N/A	829

MicroLab Hard Cards are complete "plug 'n play" high performance hard disk sub-systems. The hard disk and controller card are mounted in-line on a slimline chasis. Mounted in any open bus expansion slot, the unit saves valuable drive bay space for other peripheral devices while minimizing overall system power consumption. 5 minute installation!

Floppy Disk Drives

TOSHIBA
FUJITSU
MITSUMI



360KB Floppy *5.25", Black or Beige Bezel*	54
720KB Floppy *3.50", Black or Beige Bezel*	59
1.2MB Floppy *5.25", Beige Bezel*	68
1.44MB Floppy *3.50", Black or Beige Bezel*	69

Hard Disk Controllers

WESTERN DIGITAL CORPORATION
Seagate

MFM Controllers

Western Digital XTGEN2PLUS *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	45
Western Digital 1003VMM2 *Hard/Floppy Disk Combination, 16-Bit, 2:1 Int*	76
Seagate ST22-M *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	79
Western Digital 1006VMM2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	89
Western Digital 1004-A27X *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	45
Seagate ST11-R *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	48
Western Digital 1003VSR2 *Hard/Floppy Disk Combination, 16-Bit, 2:1 Int*	86
Seagate ST22-R *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	89
Western Digital 1006VSR2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	99

SCSI Controllers

Seagate ST-01 *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	39
Seagate ST-02 *Hard/Floppy Disk Combination, 8-Bit, 3:1 Int*	45
Western Digital 7000FASST *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	299

ESDI Controllers

Western Digital 1007VSE1 *Dual Hard Disk Controller, 16-Bit, 1:1 Int*	155
Western Digital 1007VSE2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	159

Monitors

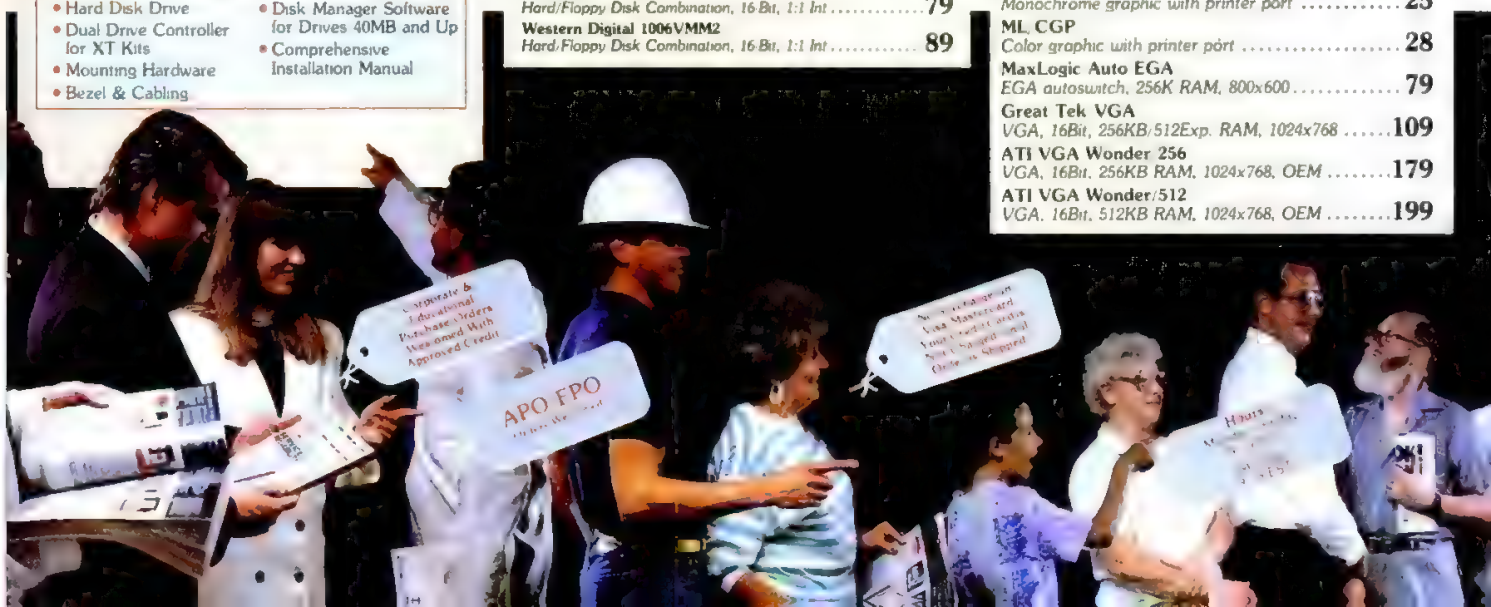
SAMSUNG
AOC
NEC

TTL Monochrome *12", Amber, 720x350, tilt/swivel base*	65
Amber Flat Screen *14", Amber, 720x350, tilt/swivel base*	97
Page White Flat Screen *14", Page White, 720x350, tilt/swivel base*	99
VGA Monochrome *14", Page White, 656x496, tilt/swivel base*	119
CGA Color *14", 640x240, tilt/swivel base*	189
EGA Color *14", 640x350, tilt/swivel base*	275
VGA Color *14", 720x400, tilt/swivel base*	299
VGA Multi-Scanning Color *14", 800x600, tilt/swivel base*	369
Super Hi-Res VGA *14", 1024x768, tilt/swivel base*	399
NEC 3D Super Hi-Res VGA *14", 1024x768, tilt/swivel base*	599

Video Graphic Boards

MaxLogic
ATI

ML MGP *Monochrome graphic with printer port*	25
ML CGP *Color graphic with printer port*	28
MaxLogic Auto EGA *EGA autoswitch, 256K RAM, 800x600*	79
Great Tek VGA *VGA, 16Bit, 256KB/512Exp. RAM, 1024x768*	109
ATI VGA Wonder 256 *VGA, 16Bit, 256KB RAM, 1024x768, OEM*	179
ATI VGA Wonder/512 *VGA, 16Bit, 512KB RAM, 1024x768, OEM*	199



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Printers

Panasonic Office Automation

star micronics

Panasonic 1180
192cps, 80 col., 9-pin 159

Panasonic 1191
240cps, 80 col., 9-pin 219

Panasonic 1124
192cps, 80 col., 24 pin 279

Panasonic 1624
192cps, 132 col., 24-pin 349

Panasonic 4420
Laser, 8pp. per minute, 22 fonts 899

Panasonic 4450i
Laser, 11pp. per minute, 28 fonts 1299

Panasonic 4455 PostScript
Laser, 11pp. per minute, 39 fonts ..... CALL

Star NX1000II
144cps, 80 col, 9-pin 159

Star NX1000 Rainbow
144cps, 80 col., 9-pin 199

Star NX1500
192cps, 132 col., 9-pin 279

Star XR1000
300cps, 80 col., 9-pin 299

Star XR1500
300cps, 132 col., 9-pin 409

Star XB2410
240cps, 80 col., 24-pin 429

Star XB2415
240cps, 132 col., 24-pin 549

Modems

CARDINAL TECHNOLOGIES INC

HYUNDAI

STAR

1200 Internal
1200/300 Baud Internal 47

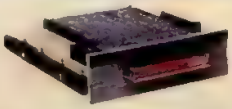
2400 Internal
2400/1200 Baud Internal 75

2400 External
2400 1200 Baud External 89

All modems are Hayes compatible and come complete with user documentation. Internal models include terminal software.

Tape Back-Ups

COLORADO MEMORY SYSTEMS INC



Colorado 60
60/40MB Internal, half-height 245

Colorado 500
500MB Internal, half height, w/host adapter 989

Tape Back-Ups come complete with data compression and back-up software. PS/2 Kit Add $69. External Kits Add $125. Tape Adapter Cards Add $69.

Chips & Co-Processors

Intel

Intel 8087-3
5Mhz for XT systems 87

Intel 8087-2
8Mhz for XT systems 119

Intel 8087-1
10Mhz for XT systems 149

Intel 80287-6
6Mhz for 286 systems 119

Intel 80287-8
8Mhz for 286 systems 187

Intel 80287-10
10Mhz for 286 systems 209

Intel 80387-SX
SX for 386 systems 279

Intel 80387-16
16Mhz for 386 systems 299

Intel 80387-20
20Mhz for 386 systems 349

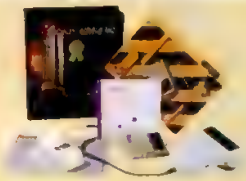
Intel 80387-25
25Mhz for 386 systems 445

Intel 80387-33
33Mhz for 386 systems 549

***Ask for current DRAM, SIPP & SIMM pricing!**

Mice & Software

Genius



Genius GM-6X
3 Button, 200-800 DPI w/Dr. Halo 20

Genius GM-6000
3 Button, 350-1050 DPI w/Dr. Halo 35

Genius GM-F302
3 Button, 350-1050 DPI w/Dr. Genius 47

Genius GeniScan
400 DPI, Bus Card w/Dr. Genius 159

System Componentry

Motherboards

ML/XT-12
4.77-12Mhz, Turbo Motherboard w/CPU 59

ML/286-12
12Mhz, 4MB EMS Motherboard w/CPU 129

ML/386-16SX
16Mhz, Neat-SX Motherboard w/CPU 329

ML 386-20SX
20Mhz, Neat SX Motherboard w/CPU 499

ML/386-25
25Mhz Motherboard w/CPU 639

ML 386-25 Cache
25Mhz, 64KB Cache Motherboard w/CPU 799

ML 386-33Cache
33Mhz, 64KB Cache Motherboard w/CPU 999

ML 486-25
25Mhz, Cache Motherboard w/CPU 2499

All MicroLab Motherboards come with comprehensive user documentation and set-up utilities.

System Componentry

System Cabinetry

ML-XT Case & Power Supply
XT Slide, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 150W Power Supply 69

ML-Baby AT Case & Power Supply
Baby AT, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 89

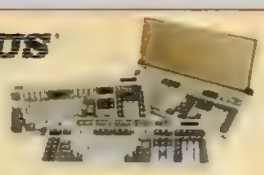
ML-PS/2 Case & Power Supply
PS/2, Slim Workstation, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 95

ML-Mini Upright Case & Power Supply
Mini Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 99

ML-Full Upright Case & Power Supply
Full Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 230W Power Supply 175

MicroLab system cases are ergonomically styled, two-tone units and come complete with speaker, generous expansion parts supply and 4-lead power supplies.

FOCUS



Keyboards

Focus FK-2001
101-Key, true tactile "click" response, mechanical Alps switch, hinged dust cover/copy holder 49

Focus FK-3001
111 Key, true tactile "click" response, mechanical Alps switch, built-in solar-powered calculator 59

Focus FK-5001
130-Key, true tactile "click" response, mechanical Alps switch, built-in battery operated calculator, both top and left-side 12-key function key layouts, keyboard templates and holder, turbo switch 79

Add-On Cards

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Dual Floppy Disk Controller 15

AT I/O
Parallel, Serial & Game Ports 19

XT Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 29

FDC-2 Multi
Two FDC (360/1.2/720/1.44) 29

FDC-4 Multi
Four FDC (360/1.2/720/1.44) Combo 39

XT High Density Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 59

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client names and information into a useful database to help you communicate more effectively with your clients, customers, and sales prospects.

Eighty/20 Advanced

by Alfred Poor

The old time-management adage teaches us that a 20-percent investment in planning will yield an 80-percent reduction in the amount of time it takes to complete a job. *Eighty/20 Advanced*, a $395 package from Eighty/20 Software, aims to save you time and effort, whether you are in sales or not.

Eighty/20 comes with the features you expect to find in a contact manager and uses a text-based interface (a bit cluttered at times) to display them. There is a batch of six user-defined fields that reside on a secondary screen, and it is not immediately obvious that they exist or how to find them.

CONVENIENT FEATURE SET

Features include the typical phone dialing (only two phone numbers per contact) and mail-merge functions. You can schedule events and keep notes on the activities. There are even appealing extras such as expense tracking and lookup tables for data entry, with context-sensitive help available for many screens. The program makes it easy to maintain a history of past actions.

There are some unusual features as well. For people involved in sales or research calls, there is a sophisticated call-scripting feature. Some programs can pop-up a list of common questions and show you the responses, but *Eighty/20* goes much further. You can build complex branching scripts, and the program will record the answers and choices taken at each juncture. Not only that, but the program will even time the length of the call so you can track how long the interviews are taking on average.

You also get automatic look-up of city and state based on ZIP codes—only a few ZIP codes are loaded when you first get the program, but the list grows automatically as you add new database records.

STRUCTURAL SHORTCOMINGS

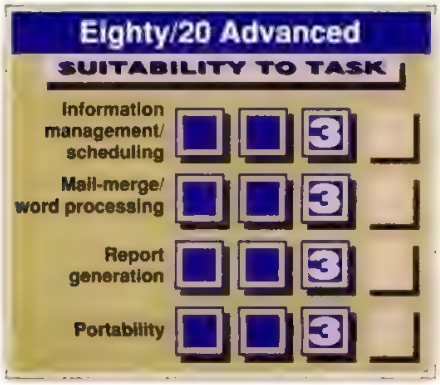
Based on *Clipper* code, *Eighty/20* uses *dBASE III* data files. While this might seem to be an advantage, it is not. Not only does *Eighty/20* Software not include any documentation of the file structure, there is no data import or export facility aside from printing a report to disk. If you want to move your data around, you need to get the Data Conversion Utility, a $50 option.

One curious fact about the file structure is that there are not separate fields for first and last names for each contact. As a result, you cannot search for a person by their last name except by searching within the entire name field. There is a "Salutation" field that can be used for first names, but in some cases you will want to address someone more formally with a title and last name, so you can't count on using this as a first name field.

The weakest parts of *Eighty/20* are the user interface and the printer support. The program does support a variety of printers, including laser printers, but the font support is primitive and the word processing features are spartan at best. The output is more convenient than a typewriter, but you'll have to forego the use of proportional fonts or other fancy formatting that you expect from most word processors.

The documentation is hefty and a bit ponderous in its style, but it is thoroughly indexed and serves well as a reference. The program is sleek enough to fit on a pair of 3.5-inch floppy disks (or a pair of high-density 5.25-inch disks) which makes

Eighty/20 Advanced **offers a variety of reports as standard features. From this screen, you can print envelopes, labels, and mail-merge letters, as well as different list formats.**



FACT FILE

***Eighty/20 Advanced*, Version 2.23**
Eighty/20 Software, 126 West Rock St., P.O. Box 3128, Mankato, MN 56002; (800) 635-8020, (507) 345-8020.
List Price: $395; network version, $995.
Requires: 460K RAM, DOS 2.0 or higher; for multiuser, DOS 3.1 or higher. Hard disk recommended.
In Short: Aside from some sophisticated script capabilities, *Eighty/20 Advanced* fails to stand out from the rest of the pack. More than adequate for many tasks, the package is less complete than competitors like *Act!* and *Sales Ally*.

CIRCLE 402 ON READER SERVICE CARD

company LAN each night and get whatever reports they need from the corporate-wide database.

SaleMaker Software also sells a corporate development system for MIS staffs who want to customize the software. The company will also do customized software for organizations with special needs.

REAL WORLD SOLUTIONS

You can also find contact management software with links to familiar accounting packages. RealWorld Corp.'s *RealWorld Sales Management Solutions* is a good example. This package can be purchased for $695, but its likely that most people will opt for the $1,995 network version. *SMS* has most of the features you'd expect in a contact management package, but it also allows sales managers to monitor income due, income received, and revenue. The package's interface matches that of the *RealWorld Accounting Series*, and it ties into RealWorld's inventory, order-entry, accounts receivable, invoicing, and job costs modules.

Because of its tight integration to the *RealWorld Accounting Series*, we don't evaluate the package here with the single-user contact managers. Its excellent connections to the accounting software make it unwieldy and hard to recommend as a standalone solution when so many low-overhead, easy-to-use alternatives are available. As part of a complete, front-to-back sales force automation system, however, *SMS* is a great addition to the widely used *RealWorld Accounting Series*.

Another approach is taken by SBT Corp., which is best known for its *dBASE*-based accounting software. SBT offers *Corporate Contact Manager*, an organization-wide contact manager that tracks all incoming and outgoing calls and their duration, and then connects all sales activity related to the calls directly to SBT accounting software. This $1,395 package generates call lists based on sales information taken from accounts receivable and sales order files, and if a fax server is available, users can send faxes directly from their PCs.

FUTURE SHOCK

As communications technology improves, contact managers are destined to become even simpler to use. You may wonder, for example, how far away we are from systems that can identify the person calling and bring up the appropriate sales record before you even answer the phone. Caller ID technology, also known as automatic number identification (ANI), which is now available in a few states (in some cases it is facing legal opposition on the grounds of privacy rights violation), would seem to make this easy to do, but there are obstacles.

First, the concept is worthwhile only for organizations like mail-order firms that handle mostly inbound calls. If you sell by making calls yourself, there's no point. Second, you face the problem of having your incoming calls identified by the PBX system of the company your client is calling from, not by his or her personal extension. And until MCI and AT&T settle on some standards, Caller ID cannot make great leaps forward, even if the ISDN technology that makes it all possible proliferates quickly.

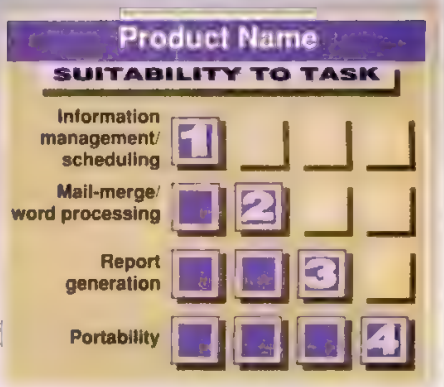
For the time being, you still need to pick up the phone to make and answer your calls, and if you do that with any frequency, a good contact manager will serve as the steel-trap memory you wish you always had.

REVIEW CRITERIA

The 15 contact management packages included in this round-up are evaluated as standalone packages designed for the individual salesperson; we will review sales-force automation packages like *SaleMaker Plus* and RealWorld's *Sales Management Software* in an upcoming issue. Although it was not required for evaluation, most of the packages can be run from one or two floppy disks, making them viable for those who take floppy disk-based portables on the road.

CONTACT MANAGEMENT SOFTWARE: SUITABILITY TO TASK

PC Magazine has assessed and assigned a point value to each contact manager's suitability for four tasks: general PIM use, word processing/mail-merge, report generation, and portability. These subjective ratings, based on a scale from 0 to 4, are presented along with each review.



THE TASKS

Information management/scheduling refers to the package's name and address management, phone-dialing capabilities, and scheduling/tickler/to-do-list features.

Ratings for **Mail-merge/word processing** reflect the package's letter generation capabilities, word processing features (or easy access to outside facilities), list extraction features, and control over nonaddress fields.

Report generation covers the package's ability to print (to disk and paper) phone books, schedules, calendars, to-do lists, and free-form reports.

Portability is an important issue both for traveling salespeople and for anyone who already has contact information in some other format. A package scores well if it fits onto a 760K floppy disk with 500 contacts included, has good facilities for updating desktop and floppy disk-based files, has the ability to share a larger database with others, and has easy import and export capabilities.

THE RATINGS

0–lacks feature or is not at all suited
1–poorly suited
2–some capability
3–well-suited
4–ideal for the task

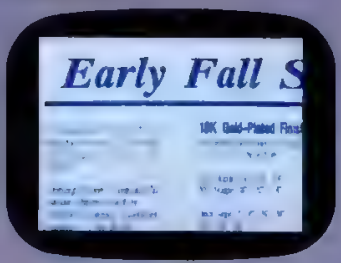
Act!

by Gregg Keizer

Emerging from a recent facelift with faster contact lookup, an impressive report generator, and the ability to schedule multiple calls, meetings, and appointments, Contact Software's *Act!*, Version 2.0, gracefully walks the wire between contact management simplicity and performance. The $395 program foretells the future of contact management software. Not only is it slick, full-featured, and economical in required keystrokes, it

IT'S OUR AGAINST

WordStar 6.0 vs. WordPerfect 5.1**



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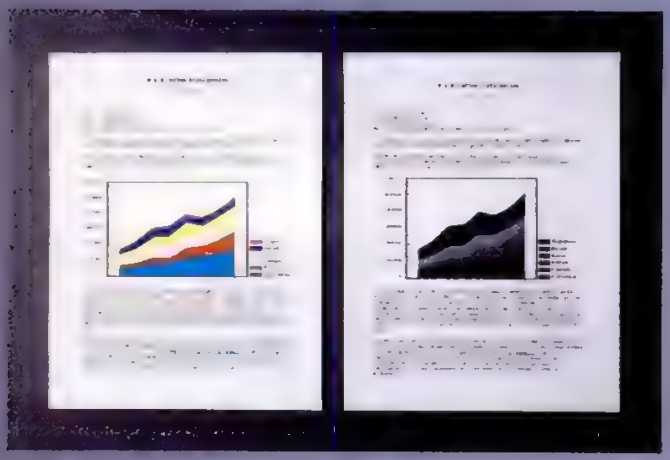
WordStar 6.0 vs. WordPerfect 5.1

WordStar comes with a Graphics Editor.

WordPerfect doesn't (it's an additional $495).

WordStar 6.0 vs. WordPerfect 5.1



We print color graphics, they don't.

WordStar 6.0 vs. WordPerfect 5.1

WordStar includes Telecommunications. WordPerfect doesn't.

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WORD THEIRS.

WordStar 6.0 vs. WordPerfect 5.1

Page preview: 144 pages vs. 2 pages.*

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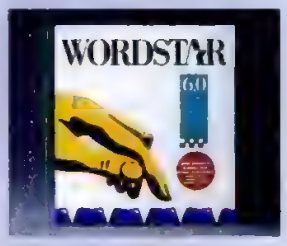
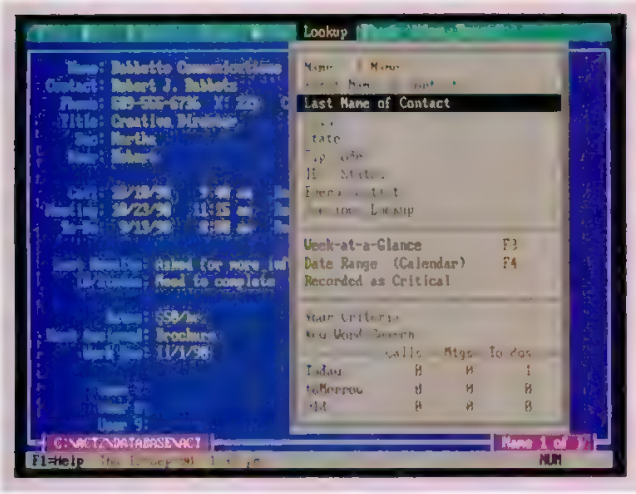


CIRCLE 510 ON READER SERVICE CARD

enables you to shell to DOS or launch another program while holding only 10K captive. This ability actually encourages you to jump from *Act!* to another application and back throughout the day.

Act! 2.0 abandons the Lotus-style primary/secondary menu system of its predecessor and debuts an easier-to-use single menu bar with pull-down options. Though the program now supports a mouse, the keyboard controls are still preferable. One reason is that you can set tab stops on any field for quick, keyboard-controlled shifts around the screen. *Act!*'s database displays 73 fields on two well-designed screens for each contact.



Act!'s Lookup search function is fast and flexible, and marks one of the major improvements in Version 2.0.

UNLIMITED CALLS

Menu selection, data entry, and general navigation are all excellent. Pop-up submenus abound, with more than half of the fields linked to pop-ups that hold common responses. You can customize nearly all the submenus to speed up data entry. In most cases, manipulating *Act!* becomes second nature quickly, even with extensive use of function-key combinations.

Act! integrates several important tools with its contact database. The package includes a simple word processor with spell checker, calendar, to-do list, contact note writer, contact summary, weekly scheduler, and expense recorder. All features are linked with the contact file and can handle many repetitive chores, such as automatically inserting the contact's name and address in a letter's salutation. You can schedule an unlimited number of future calls or meetings, or list an unlimited number of tasks for each contact. That's a major improvement over earlier versions.

Telephone-related support is solid, and a timer to record the duration of calls can be switched on and off for your billing purposes. All calls, incoming or outgoing, are logged to the contact's activity file. You can utilize nine predefined reports or design almost any kind of custom report with *Act!*'s powerful and complex report generator.

Contact Software has added an impressive list of features to Version 2.0, yet it lacks password security and doesn't spot duplicate entries. The task list includes calls, meetings, and to-do tasks, but would be even more valuable if you could prioritize uncompleted tasks or automatically roll them over to the next day. While the pop-up submenus make contact information entry fast, there's no way to copy all, or even some, of your entry to another entry in your client files.

FACT FILE
EDITOR'S CHOICE

***Act!*, Version 2.0**
Contact Software International Inc., 1625 W. Crosby Rd., #132, Carrollton, TX 75006; (214) 418-1866.
List Price: $395; upgrade from 1.1, $69.95.
Requires: 640K RAM, hard disk, DOS 3.0 or later.

In Short: *Act!* is a powerful, yet easy-to-use program that's better equipped to handle nonsales contact management tasks than any other program. A significant upgrade to an already solid program, it can now locate a contact much faster and schedule an unlimited number of future calls, meetings, and tasks for each contact.

CIRCLE 398 ON READER SERVICE CARD

ONE TO BEAT

Few contact managers come close to *Act!*'s depth or breadth. You can boot *Act!* at 8:00 A.M. and remain within it until 5:00 P.M., all the while handling calls, writing letters, and taking notes. When you need your spreadsheet or full-featured word processor, you can easily drop out of *Act!* and return to it quickly. Its database search, though much improved and considerably faster and more efficient than before, still doesn't match *The Maximizer*'s speed. *Act!* is an excellent contact manager both for sales and nonsales use, but it lacks the telemarketing features that phone-intensive salespeople may require.

Nevertheless, the jump to Version 2.0 puts *Act!* ahead of most of the competition. *Act!* is one of the most powerful general contact managers available—in great part due to its generous feature list and minimal keystrokes required for most tasks. *Act!* works better in a nonsales capacity than any other contact manager, and therefore has the best potential to help push contact management farther into the software mainstream.

Action Plus

by Emerson A. Torgan

With the ability to attach up to 50 different graphic images to each one of its detailed contact screens, Action Plus Software's *Action Plus*, Version 4.02, is a unique contact manager. The $495 package is at its most impressive when running on a desktop PC, but it will run on a laptop if you sacrifice the on-line help, the on-line users manual, and the satellite module that allows tranfer of records from one *Action Plus* system to another. Attaching anything that can be scanned and/or saved as a .PCX file to a contact record gives the telemarketer the ability to see and de-

FACT FILE

***Action Plus*, Version 4.02**
Action Plus Software, 11485 South High Mountain Dr., Salt Lake City, UT 84092; (801) 572-3303.
List Price: $495; network version, $1,495.
Requires: 640K RAM, hard disk, DOS 3.3 or later.
In Short: *Action Plus* offers detailed contact informaton and versatile search features that can be as simple or complex as the situation dictates. The unique ability of the package to attach graphic images to a profile and display them on screen seperates *Action Plus* from the rest of the pack.

CIRCLE 399 ON READER SERVICE CARD

scribe the items in inventory.

If you have the discipline to update the many detailed and date-oriented fields of each contact record, you will be rewarded with a clear and concise report of any transaction, contractual agreement, phone call, or letter that may have transpired. By utilizing specific entries, such as ID numbers and a code space with which you could tag profiles specifically as "Widgets" or "California," you can minimize the time needed to search through your database. Another helpful feature is the space for contact gender, especially useful when you deal with unisex names like Terry or Pat.

The screens are packed with information relating to your contact: name, company, address, position, first and last dates of communication, notes, sales commission and contract status, ID numbers, tax ID, code, and phone number entries that can be customized up to ten digits. At first it seems a bit overwhelming to have so much on screen at once, but any salesperson will value the comprehensiveness.

Functions such as Add, Delete, Find, and List are executed with first-letter keystrokes, function keys, or cursor placement.

SEARCHING WITH SPEED

When speed is essential, *Action Plus* offers two ways to pull up a profile: Quick Search, which lets you search only by last name or company, or Complex Search, which opens a blank contact record and lets you fill in as much criteria as you want. The more specific you are, the quicker you'll find the desired record.

The calendar functions as a daily planner and accepts entries as appointments or to-do tasks. Meetings are displayed graphically as a bar that extends over a fixed time line running from 7 A.M. to 8 P.M. across the bottom of the screen. When attempting to schedule conflicting or overlapping meetings, *Action Plus* warns you and will accept the conflict, changing the color of a portion of the bar to illustrate the length of each meeting.

The expense report feature is another convenience for the salesperson on the move. Odometer readings can be calculated within this field at an adjustable expense rate, and total billable hours to a client can be added up and printed with the appropriate names and dates.

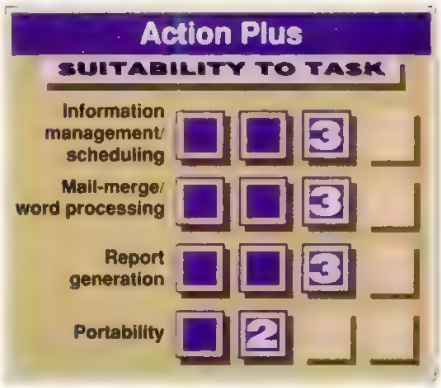
WHAT'S MISSING?

With five viewing fields, a free-form notepad, a calendar, 20 different telemarketing scripts and form letters, invoices and report generators, expense and appointment records, and the ability to log 99 million profiles and 1 billion items in inventory, *Action Plus* is fairly complete. But it is by no means perfect.

The package is a memory hog, rendering the exit-to-DOS function basically useless. *Action Plus* is not a TSR, so when the phone rings you need to load it in order to view the appropriate profile. It also lacks a calculator.

The advantages of *Action Plus* center around its detailed contact records and its ability to attach images. Like other contact managers, it requires a commitment from you to update the database. Although what is sacrificed through commitment is returned in speed—when speed really counts.

Action Plus's thorough main data-entry screen has a spot for just about every piece of contact information. At the bottom of the screen are two rows of menus—the top row is activated by function keys and the bottom row by positioning the cursor or typing the first letter.



Biz*Base Gold

by Alfred Poor

A basic part of microcomputer software lore is the story of the end user who developed a program that others wanted to use, so the author published it and sold lots of copies. *Biz*Base Gold* is an example of this "kitchen table" software success story. With a list price of $175 and a complete list of features, the program from Creagh Computer Systems looks

like an attractive value. Unfortunately, its apparent strengths do not hold up to closer scrutiny.

Developed from *Clipper* and other *dBASE*-related tools, *Biz*Base Gold* shows many tell-tale signs of evolutionary growth and inconsistent execution of design strategy.

THE LOOK AND FEEL

The character-based text screens are attractive, and the color choices for displays are reasonable. You can alter the heading for just about every field, giving you the flexibility to alter the appearance of the stored data. There are seven character fields, six date fields, six numeric fields, and six logical fields that are intended for user-definable information and provide plenty of flexibility. Since you can define additional indexes for database searching and reporting, you have added flexibility.

There is also context-sensitive on-line help. If the program is unable to decipher the information you need, it presents a windowed index of help topics and you can choose the one you want. Here is where the frayed edges start to appear. The help screens are limited in content, and some topics, such as printer setup strings, are missing entirely. Some help screens only provide a sales pitch for other products from the publisher, such as the collection of canned mail-merge letters. (The sample mail-merge letters provided with the program start with a header that spells out the deal as well.)

THE CHALLENGES

Turn to the manual for support, and you are thwarted again. The index does not provide entries for fundamental items such as "Printer" or "Envelopes." The manual is primarily a loose mixture of tutorial and reference. There are typos, words that run together without spaces, and the useful information in the documentation is often difficult to find.

The user interface provides additional challenges. There are many function keys active at a given time, but only some are listed at the bottom of the screen. Some assignments are not intuitive; to create a letter for the record on screen, you don't select "Correspondence," but instead use "Forms." A function-key template and a pop-up reference window help you remember the assignments, but you'll need the manual to keep track of the options. And when you use the Escape key to back out of an operation, you are often returned back to the top level rather than the prior step. This means a lot of repeated work when you select the wrong report or label format, and getting dumped back to the program's opening screen.

There is no built-in support for printers. Instead, you are directed to study your printer manual so you can enter the correct Escape sequences. This is all well and good, but it means that the program's word processor won't space your 10-point Times Roman laser font correctly.

One bright point, however, is data import. Provided that you have your data in a *dBASE*-compatible format, you can assign fields one by one to match up with the corresponding *Biz*Base* format. On the other hand, if you only have a comma-delimited or fixed-length format, the data must match the *Biz*Base* format precisely. Unfortunately, the manual does not entirely explain the complexities of this task.

HELP ON THE WAY

According to a company representative, Creagh Computer Systems was a month away from releasing Version 2 of *Biz*Base* at the time of this review. The new version is reportedly a complete overhaul of Version 1.1, with more features, new file structures, and new documentation.

The version of *Biz*Base Gold* tested here has some sophisticated scheduling and to-do list features and offers suitable extras, such as a pop-up calculator, spell checking, time and date stamping, and alarms. If there were no other programs available in this category, it would be a treasure because you certainly can do a lot of useful work with it. The problem is that it is so uneven and is missing so many important features that it does not hold up in comparison with the competition.

FACT FILE

***Biz*Base Gold*, Version 1.1**
Creagh Computer Systems Inc., 674 Via de la Valle, #204, Solana Beach, CA 92075; (800) 833-8892, (619) 792-1367.
List Price: $175; four-user version, $600; additional four-user modules, $400.
Requires: 640K RAM, DOS 3.0 or later, hard disk.
In Short: *Biz*Base Gold* has evolved from one man's tool to a full-fledged general purpose product, but this evolutionary growth has left some holes and rough edges that make the package far less attractive than some of its more polished competitors.

CIRCLE 400 ON READER SERVICE CARD

*Biz*Base Gold* offers a straightforward "Find" feature as well as a more-complex query function. You can build queries using any field and menu-driven selections. When a phrase of the query is complete, the program shows it in the box to the right.

Business Contacts and Information Manager

by Carol Levin

For the uninitiated user of contact management software, functional simplicity is a strong advantage and one that's the core of *Business Contacts and Information Manager*, Version 1.1, sold by Disk-Count Software for $69.95. Yes, $69.95.

The price you pay for ease of use is limited options and some awkward compromises that more-robust and costly packages overcome. *BCIM* is not an

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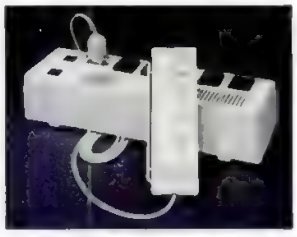

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FACT FILE

***Business Contacts and Information Manager,* Version 1.1**
Disk-Count Software Inc., 1751 West County Rd. B, #107, St. Paul, MN 55113; (612) 633-2300.
List Price: $69.95.
Requires: 512K RAM, DOS 2.0 or later.
In Short: *BCIM* can help you communicate more effectively with your clients with a minimum of effort. If you don't need any fancy phone work or relish the thought of wrestling with contact management software, the no-frills *BCIM* could work for you.

CIRCLE 401 ON READER SERVICE CARD

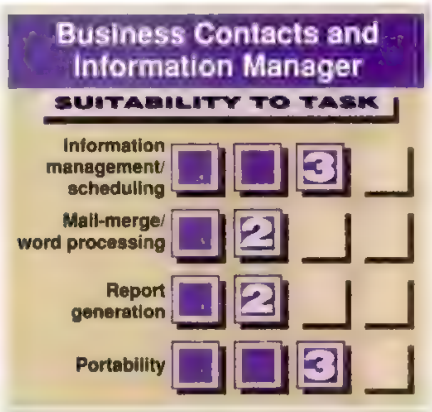
ambitious package, yet should satisfy the expectations of the entry-level user and buyers resisting steep prices.

As a modified knockoff of Eighty/20 Software's *Expeed*, *BCIM* users receive an attractive upgrade policy to Eighty/20's line of contact managers. You can convert your data automatically to these more-powerful packages, which include expense tracking, statistical data, multiple databases, and data import and export. *BCIM*'s built-in obsolescence positions Eighty/20 products in Disk-Count Software's wide retail distribution stream.

BCIM can do essentially what other contact managers do—replace your Rolodex, to-do list, calendar, and even function as a simple personal information manager. Version 1.1 condenses the program's code from three to one floppy disk for easy installation on a laptop, enabling you to tote your office everywhere. The Start-Up Guide takes you step-by-step through *BCIM* using a dummy list of contacts, memos, and letters, so you probably won't need to print the 100-page manual that's supplied only on disk.

SIMPLE SCREENS

The screen architecture is only a few levels deep with four main-menu choices: Daily Schedule Update, Client Access Menu, Maintenance Menu, and Report Menu. The bottom row of 15 selections quickly allows you to edit, print, display a schedule, or type a letter. A handful of hot keys access context-sensitive help, a notepad, and monthly calendar. Most daily work is oriented around the Client Profile screen—a screen that accesses every bit of information you've stored about clients, including company and contact name, address, phone numbers, and notes, as well as ten user-defined descriptors. You can conveniently add contact names to a company already on the system without retyping repetitive information.



The rather rigid design of the Client Profile screen prohibits city names longer than 15 characters, and the ZIP code format can't be modified for Canadian codes, such as M4V 2Z5. There is space for two 10-digit telephone numbers, but you can't identify them with specific labels indicating fax, extension, or e-mail.

From the Client Access menu you can launch searches as well as edit, shuffle, and sort your stack of Rolodex cards. There's also an auto-dialer, mail-merge facilities, a skeletal word processor, an assortment of customizable business letters, and ten generic reports that offer a moderate customization. For a low-end package, the printing formats are sufficient, including 2-by 4-inch and 3- by 5-inch Rolodex cards, 1- and 2-column formats, envelopes, and labels.

One of the more-convenient viewing features is the Daily Update of Schedule Dates, which reminds you of all the phone calls, meetings, and letters you've neglected. You can also view a schedule for each client; a group of clients by filter; a monthly calendar; a daily schedule; and a history of each client.

There are ten customizable descriptors that use three-letter abbreviations to further identify clients and two search methods. Using the "By Example" approach, you identify specific criteria and send the system on a search of all clients that match the filter. The "By Sub-Group" approach saves filters and expedites tasks such as printing and reporting.

THE FUNCTIONALITY TRADE-OFF

One particularly irksome limitation forces you to attach all appointments to a particular client. To schedule a holiday, you must first enter it on a Client Profile screen. The date will then be posted directly to the monthly calendar, and the holiday will appear in your list of clients, a rather compromising solution.

Other limitations are: a monthly calendar that fits only two lines of ten characters per day. There is no warning that you've scheduled conflicting meetings, so you can plan two or more meetings that start at the same time. You're also restricted to one database, which prohibits extensive customization. One final tradeoff is *BCIM*'s lack of integration. There are three locations to jot a memo of any length, but you may forget exactly where you stored it. Lacking text retrieval capability, the system leaves you to hunt down the memo yourself.

With a rock bottom price tag, *BCIM* is a back-to-basics package that provides just enough power to turn an unruly list of

Using the "By Example" search with two filters—architecture firms and Eastern territory—this *Business Contacts and Information Manager* search displays its first hit. From here, you can auto-dial this customer, flip to the next client rounded up in this search, or select a letter to send.

PCs beat Macs for Illustration

REPORT CARD
AUGUST 20, 1990

INFO WORLD

Illustration Software

	(InfoWorld weighting)	(Your weighting)	PC: Adobe Illustrator Version 1.0	PC: Arts & Letters Graphics Editor Version 3.0	PC: Corel Draw version 1.2.1	MACINTOSH: Micrografx Designer Version 3.0.1	MACINTOSH: Adobe Illustrator Version 1.9.5	MACINTOSH: Aldus Freehand Version 2.0.2	MACINTOSH: CA-Cricket Draw Version 1.1.1	MACINTOSH: Canvas version 2.1
Price			$495	$695	$595	$695	$495	$495	$295	$299
Performance										
Drawing/editing	(150)	( )	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Satisfactory	Good
Tracing	(50)	( )	Very Good	Very Good	Very Good	Excellent	Very Good	Satisfactory	Poor	Good
Import/export	(50)	( )	Satisfactory	Satisfactory	Very Good	Very Good	Good	Good	Satisfactory	Very Good
Speed	(50)	( )	Satisfactory	Very Good	Excellent	Good	Excellent	Satisfactory	Good	Good
Output quality	(100)	( )	Good	Good	Excellent	Very Good	Excellent	Very Good	Satisfactory	Satisfactory
Documentation	(100)	( )	Very Good	Good	Very Good	Excellent	Very Good	Good	Satisfactory	Satisfactory
Ease of learning	(100)	( )	Very Good	Good	Excellent	Very Good	Satisfactory	Good	Very Good	Good
Ease of use	(125)	( )	Satisfactory	Very Good	Very Good	Very Good	Satisfactory	Very Good	Satisfactory	Very Good
Error handling	(75)	( )	Good	Poor	Good	Good	Good	Very Good	Good	Very Good
Support										
Support policies	(50)	( )	Satisfactory	Good	Good	Very Good	Satisfactory	Satisfactory	Satisfactory	Good
Technical support	(50)	( )	Satisfactory	Very Good	Very Good	Very Good	Good	Good	Very Good	Very Good
Value	(100)	( )	Satisfactory	Good	Excellent	Very Good	Very Good	Very Good	Satisfactory	Very Good
Final scores			**6.0**	**6.4**	**8.2**	**7.7**	**6.9**	**6.8**	**5.4**	**6.5**
Use your own weightings to calculate your score										

GUIDE TO REPORT CARD SCORES

InfoWorld reviews only finished, production versions of products, never beta test versions.
Products receive ratings ranging from unacceptable to excellent in various categories. Scores are derived by multiplying the weighting (in parentheses) of each criterion by its rating, where:
Excellent = 1.0 — Outstanding in all areas
Very Good = 0.75 — Meets all essential criteria and offers significant advantages
Good = 0.625 — Meets essential criteria and includes some special features
Satisfactory = 0.5 — Meets essential criteria
Poor = 0.25 — Fails short in essential areas
Unacceptable or N/A = 0.0 — Fails to meet minimum standards or lacks this feature
Scores are [illegible] divided by 100, and rounded down to one decimal place to yield the final score [illegible] Products rated within 0.2 points of one another [illegible] to *InfoWorld* readers [illegible]

CorelDRAW wins InfoWorld Evaluation

In a pivotal InfoWorld product comparison, CorelDRAW running under Windows 3.0, beats all the leading illustration packages - Macs included! This shows the effectiveness of the Windows 3.0 graphical user interface and the power and ease of use of CorelDRAW, the world's finest PC illustration software.

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CIRCLE 729 ON READER SERVICE CARD

Requires MS-WINDOWS® 2.03 or 3.0

Complete Systems... No U

Complete Systems Philosophy

MicroLab computers are renowned for their industry leading technology, performance and pricing.

We only sell complete systems. Monitors and hard disks are standard in every one.

Look closely. Some ads boast low cost "base" units primarily to attract your initial interest. Known as fly paper advertising, they serve only as a price starting point, often requiring a floppy disk or monitor to become a truly complete, functional system.

MicroLab customers are smart. They demand a bargain and a complete solution.

Plus they avoid sticky situations.

Custom System Configurations

Along the same lines, we realize that not every customer will want a fully loaded system. Least wise, not the exact way we've configured it.

That's where our highly trained Systems Consultants come in.

Tell them you want a modem or tape back up installed off the bat and they'll lay out all your options.

Tell them you're a student on a budget and they'll help you configure a system that will economically suit your current needs while providing for future expansion.

Tell them you're really into CAD or Desktop Publishing and they'll drive home your many CPU, video, graphics controller and co-processor options.

Go ahead. Ask them. They especially love this part of their job.

Consistently Superior Quality

Each MicroLab system is hand assembled and put through a 72-hour battery of stringently administered diagnostic tests. All to assure "bugs free" operation prior to shipment.

Your system is made in the U.S.A. and is shipped straight to you.

Fast. Direct. No middlemen.

And only the finest name brand, state-of-the-art components are used in each system we build.

No old technology or off-brand, low-cost "box stuffers" used here.

That's a promise. And a commitment!

Attention to Detail

At MicroLab, we believe your system should look as good as it performs. So it's no wonder our customers applaud the unique, trendsetting two-tone styling of our system cabinetry.

MICROLAB™ 486/25

- 4MB RAM-expandable to 16 MB
- Intel Co-Processor On Board
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 160MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Super VGA 160MB System $5195

Video Options — Include Monitor & Video Card

MICROLAB 486/25 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Interleave	$2745	$2795	$2895	$4045	$4095	$4145	$4245
40MB - 1:1 Interleave	$2795	$2845	$2945	$4095	$4145	$4195	$4295
65MB - 1:1 Interleave	$2895	$2945	$4045	$4195	$4245	$4295	$4395
80MB - 1:1 Interleave	$4195	$4245	$4345	$4495	$4545	$4595	$4695
120MB - 1:1 Interleave	$4295	$4345	$4445	$4595	$4645	$4695	$4795
160MB - 1:1 Interleave	$4695	$4745	$4845	$4895	$4945	$5095	$5195
320MB - 1:1 Interleave	$5295	$5345	$5445	$5595	$5645	$5695	$5795

Makes a great LAN Server or Multi Tasking Workstation!

• Optional case styles available • FREE MS-DOS 3.3 or 4.01

MS-DOS®, UNIX®, OS/2® & Novell® Compatible

Landmark: 114.1 - Norton: 38.8

MICROLAB™ 386 Cache/25 & 386 Cache/33

- 4MB RAM-expandable to 8 MB
- 64KB Cache RAM On Board
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 120MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Super VGA 120MB System $3245*

Video Options — Include Monitor & Video Card

MICROLAB 386 Cache/25 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Interleave	$2195	$2245	$2345	$2495	$2545	$2595	$2695
40MB - 1:1 Interleave	$2245	$2295	$2395	$2545	$2595	$2645	$2745
65MB - 1:1 Interleave	$2345	$2395	$2495	$2645	$2695	$2745	$2845
80MB - 1:1 Interleave	$2645	$2695	$2795	$2945	$2995	$3045	$3145
120MB - 1:1 Interleave	$2745	$2795	$2895	$3045	$3095	$3145	$3245
160MB - 1:1 Interleave	$3145	$3195	$3295	$3445	$3495	$3545	$3645
320MB - 1:1 Interleave	$3745	$3795	$3895	$4045	$4095	$4145	$4245

Makes an ideal CAD Workstation! *[illegible]

• Optional case styles available • FREE MS-DOS 3.3 or 4.01

MS-DOS®, UNIX®, OS/2® & Novell® Compatible

Landmark: 40.5/53.5 - Norton: 29.3/38.2

MICROLAB™ 386/25

- 2MB RAM-expandable to 8 MB
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 80MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Super VGA 80MB System $2645

Video Options — Include Monitor & Video Card

MICROLAB 386/25 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi-Res 14" 1024x768
30MB - 1:1 Interleave	$1695	$1745	$1845	$1895	$2045	$2095	$2195
40MB - 1:1 Interleave	$1745	$1795	$1895	$2045	$2095	$2145	$2245
65MB - 1:1 Interleave	$1845	$1895	$1995	$2145	$2195	$2245	$2345
80MB - 1:1 Interleave	$2145	$2195	$2295	$2445	$2495	$2545	$2645
120MB - 1:1 Interleave	$2245	$2295	$2395	$2545	$2595	$2645	$2745
160MB - 1:1 Interleave	$2645	$2695	$2795	$2945	$2995	$3045	$3145
320MB - 1:1 Interleave	$3245	$3295	$3395	$3545	$3595	$3645	$3745

• *Makes a great desktop publishing system!*

• Optional case styles available • FREE MS-DOS 3.3 or 4.01

MS-DOS®, UNIX®, OS/2® & Novell® Compatible

Landmark: 35.6 - Norton: 28.2

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Technical Support - On Our Dime

All MicroLab systems come with operations documentation and are easy to use. Should you require personal assistance, our technical support team is staffed by trained, courteous Systems Engineers ready to help Just a toll free call away

And everyone knows (800) calls are costly So when MicroLab decided to offer NATIONAL TOLL FREE technical support, some people thought us either gluttons for expense...or confident our customers wouldn't have to use it too often

We like to think we're just confident

30 Day Money Back Guarantee

Your complete satisfaction is at the heart of every system we build

So purchase your system with complete confidence Put it through its paces. Kick the tires for 30 days

If dissatisfied, simply contact us to initiate its expedient return and a prompt refund on the hardware price

No questions. No hassles

Iron Clad Warranty

MicroLab computers are rugged, solid performers built for compatibility and reliability.

We stand behind every system manufactured with a comprehensive 1 Year Limited Warranty on all required parts and labor.

Additionally, MicroLab offers its popular S.W.A.P. (Supplemental Warranty Assurance Program) Extended Warranty Policy for additional warranty protection at a nominal price

Be sure to ask your consultant for details

MicroLab's Commitment

MicroLab is a wholly owned subsidiary of the National Microcomputer Research Institute, an organization dedicated to the advancement of microcomputer technology

We've evolved into a preferred vendor for government, educational and corporate institutions alike

We'd like nothing more than to be yours, too

It's As Easy As Calling 1-800-677-7900

Whether you've got your eye on a pre-configured MicroLab system or need assistance configuring one, call us today

The call's on us!

MICROLAB 386/SX-16 & 386/SX-20

- 2MB RAM-expandable to 8 MB
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 65MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- 14" Super VGA 1024x768 Monitor
- 16 Bit VGA Adaptor with 512K
- 2 Serial, 1 Parallel & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

Complete Super VGA 65MB System $1995*

Video Options — Include Monitor & Video Card

MICROLAB 386/SX-16 Price Matrix	Mono Chrome 12" 720x350	Mono Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi Res 14" 1024x768
30MB 1:1 Interleave	$1345	$1395	$1495	$1545	$1695	$1745	$1845
40MB 1:1 Interleave	$1395	$1445	$1545	$1595	$1745	$1795	$1895
65MB 1:1 Interleave	$1495	$1545	$1645	$1795	$1845	$1895	$1995
80MB 1:1 Interleave	$1795	$1845	$1945	$2095	$2145	$2195	$2295
120MB 1:1 Interleave	$1895	$1945	$2045	$2195	$2245	$2295	$2395
160MB 1:1 Interleave	$2295	$2345	$2445	$2595	$2645	$2695	$2795
320MB - 1:1 Interleave	$2895	$2945	$3045	$3195	$3245	$3295	$3395

386 Performance with 286 Compatibility!

• Optional case styles available • FREE MS-DOS 3.3 or 4.01

MS DOS®, UNIX®, OS/2® & Novell® Compatible
Landmark: 21/25.4 · Norton: 17.6/22.0

MICROLAB 286/12

- 1MB RAM-expandable to 4 MB
- 1.2MB 5.25" Floppy Disk Drive
- 1.44MB 3.5" Floppy Disk Drive
- 30MB Hard Disk Drive
- High Speed 1:1 Interleave Hard/Floppy Disk Drive Controller
- Hi Res Monochrome Monitor
- Monochrome Video Adaptor
- 2 Serial, 1 Parallel, & 1 Game Port
- 101 Key Tactile Switch Keyboard
- MS-DOS 3.3 or 4.01

Complete Monochrome 30MB System $995

Video Options — Include Monitor & Video Card

MICROLAB 286/12 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi Res 14" 1024x768
30MB 1:1 Interleave	$ 995	$1045	$1145	$1295	$1345	$1395	$1495
40MB 1:1 Interleave	$1045	$1095	$1195	$1345	$1395	$1445	$1545
65MB 1:1 Interleave	$1145	$1195	$1295	$1445	$1495	$1545	$1645
80MB 1:1 Interleave	$1445	$1495	$1595	$1745	$1795	$1845	$1945
120MB 1:1 Interleave	$1845	$1895	$1995	$1845	$1895	$1945	$2045
160MB 1:1 Interleave	$1945	$1995	$2095	$2245	$2295	$2345	$2445
320MB 1:1 Interleave	$2545	$2595	$2695	$2845	$2895	$2945	$3045

Makes an ideal small business system!

• Optional case styles available • FREE MS-DOS 3.3 or 4.01

MS-DOS® UNIX®, OS/2® & Novell® Compatible
Landmark: 16.1 · Norton: 13.4

MICROLAB XT/12

- 640KB RAM expandable to 1MB
- 360KB 5.25" Floppy Disk Drive
- 30MB Hard Disk Drive
- Hard/Floppy Disk Drive
- Hi Res Monochrome Monitor
- Monochrome Video Adaptor
- Serial, Parallel & Game Ports
- 101 Key Tactile Switch Keyboard
- MS DOS 3.3 or 4.01

Complete Monochrome 30MB System $745

Video Options — Include Monitor & Video Card

MICROLAB XT/12 Price Matrix	Mono-Chrome 12" 720x350	Mono-Flat 14" 720x350	CGA Color 14" 640x200	EGA Color 14" 640x350	VGA Color 14" 640x480	VGA Multi 14" 800x600	VGA Hi Res 14 1024x768
30MB 1:1 Hard Disk	$ 745	$ 795	$ 895	$1045	$1095	$1145	$1245
40MB 1:1 Hard Disk	$ 795	$ 845	$ 945	$1095	$1145	$1195	$1295
65MB 1:1 Hard Disk	$ 895	$ 945	$1045	$1195	$1245	$1295	$1395
80MB 1:1 Hard Disk	$1195	$1245	$1345	$1495	$1545	$1595	$1695
120MB 1:1 Hard Disk	$1295	$1345	$1445	$1595	$1645	$1695	$1795

Makes a great home or student system!

• FREE MS DOS 3.3 or 4.01

Landmark Speed Test: 13.4

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Name Brand Products. Rock Bot

Hard Disk MicroKits

Seagate
KALOK

5.25" Hard Drives

	Drive Only	AT Kit	XT Kit
Seagate ST225 *20MB, 65ms, MFM, HH*	178	183	223
Seagate ST238R *30MB, 65ms, RLL, HH*	195	200	243
Seagate ST250R *40MB, 68ms, RLL, HH*	199	204	249
Seagate ST251-1 *40MB, 28ms, MFM, HH*	269	274	315
Seagate ST277R-1 *65MB, 28ms, RLL, HH*	299	304	339
Seagate ST296N *80MB, 28ms, SCSI, HH*	399	404	449
Seagate ST4096 *80MB, 28ms, MFM, FH*	517	522	557
Seagate ST4144R *120MB, 28ms, RLL, FH*	569	574	609
Seagate/Imprimis ST4182E *160MB, 17ms, ESDI, FH*	949	INQUIRE	
Seagate/Imprimis ST4182N *155MB, 17ms, SCSI, FH*	979	INQUIRE	
Seagate/Imprimis ST4350N *307MB, 18ms, SCSI, FH*	1399	INQUIRE	
Seagate/Imprimis ST4384E *329MB, 15ms, ESDI, FH*	1599	INQUIRE	
Seagate/Imprimis ST2383E *337MB, 16ms, ESDI, HH*	1599	INQUIRE	
Seagate/Imprimis ST2383N *338MB, 16ms, SCSI, HH*	1629	INQUIRE	
Seagate/Imprimis ST4766E *676MB, 16ms, ESDI, FH*	2099	INQUIRE	
Seagate/Imprimis ST4766N *676MB, 16ms, SCSI, FH*	2149	INQUIRE	
Seagate/Imprimis ST41200N *1050MB, 17ms, SCSI, FH*	3899	INQUIRE	

3.50" Hard Drives

	Drive Only	AT Kit	XT Kit
K/Lok KL320 *20MB, 40ms, MFM, HH*	169	174	215
K/Lok KL330 *30MB, 40ms, RLL, HH*	179	184	229
Seagate ST138R *30MB, 40ms, RLL, HH*	249	254	295
Seagate ST157R *50MB, 40ms, RLL, HH*	275	279	319
Seagate/Imprimis ST1100 *88MB, 15ms, MFM, HH*	649	654	697
Seagate/Imprimis ST1162N *142MB, 15ms, SCSI, HH*	779	INQUIRE	
Seagate/Imprimis ST1201E *177MB, 15ms, ESDI, HH*	1029	INQUIRE	
Seagate/Imprimis ST1201N *177MB, 15ms, SCSI, HH*	1049	INQUIRE	

MicroLab MicroKits Include:

- Hard Disk Drive
- Dual Drive Controller for XT Kits
- Mounting Hardware
- Bezel & Cabling
- Disk Manager Software for Drives 40MB and Up
- Comprehensive Installation Manual

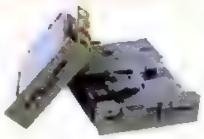
MicroLab Hard Cards

	8 Bit	Tandy	SCSI	16 Bit
Hard Card/20 *20MB, 40ms*	245	265	339	359
Hard Card/30 *30MB, 40ms*	269	289	359	375
Hard Card/50 *50MB, 40ms*	349	369	439	539
Hard Card/90 *88MB, 15ms*	699	719	N/A	829

MicroLab Hard Cards are complete "plug 'n play" high performance hard disk sub-systems. The hard disk and controller card are mounted in-line on a slimline chasis. Mounted in any open bus expansion slot, the unit saves valuable drive bay space for other peripheral devices while minimizing overall system power consumption. 5 minute installation!

Floppy Disk Drives

TOSHIBA
MITSUMI



360KB Floppy *5.25", Black or Beige Bezel*	54
720KB Floppy *3.50", Black or Beige Bezel*	59
1.2MB Floppy *5.25", Beige Bezel*	68
1.44MB Floppy *3.50", Black or Beige Bezel*	69

Hard Disk Controllers

WESTERN DIGITAL CORPORATION
Seagate

MFM Controllers

Western Digital XTGEN2PLUS *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	45
Western Digital 1003VMM2 *Hard/Floppy Disk Combination, 16-Bit, 2:1 Int*	76
Seagate ST22-M *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	79
Western Digital 1006VMM2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	89
Western Digital 1004-A27X *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	45
Seagate ST11-R *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	48
Western Digital 1003VSR2 *Hard/Floppy Disk Combination, 16-Bit, 2:1 Int*	86
Seagate ST22-R *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	89
Western Digital 1006VSR2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	99

SCSI Controllers

Seagate ST-01 *Dual Hard Disk Controller, 8-Bit, 3:1 Int*	39
Seagate ST-02 *Hard/Floppy Disk Combination, 8-Bit, 3:1 Int*	45
Western Digital 7000FASST *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	299

ESDI Controllers

Western Digital 1007VSE1 *Duall Hard Disk Controller, 16-Bit, 1:1 Int*	155
Western Digital 1007VSE2 *Hard/Floppy Disk Combination, 16-Bit, 1:1 Int*	159

Monitors

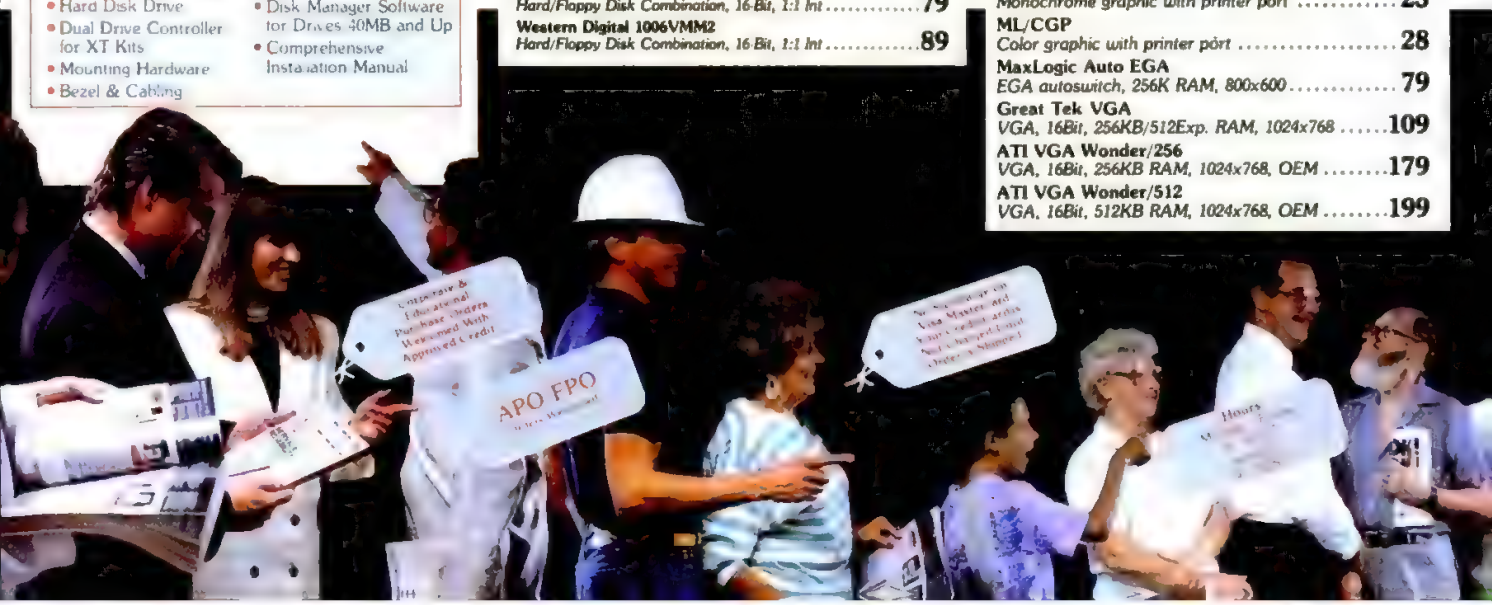
SAMSUNG
ADC
NEC

TTL Monochrome *12", Amber, 720x350, tilt/swivel base*	65
Amber Flat Screen *14", Amber, 720x350, tilt/swivel base*	97
Page White Flat Screen *14", Page White, 720x350, tilt/swivel base*	99
VGA Monochrome *14", Page White, 656x496, tilt/swivel base*	119
CGA Color *14", 640x240, tilt/swivel base*	189
EGA Color *14", 640x350, tilt/swivel base*	275
VGA Color *14", 720x400, tilt/swivel base*	299
VGA Multi-Scanning Color *14", 800x600, tilt/swivel base*	369
Super Hi-Res VGA *14", 1024x768, tilt/swivel base*	399
NEC 3D Super Hi-Res VGA *14", 1024x768, tilt/swivel base*	599

Video Graphic Boards

MaxLogic
ATI

ML/MGP *Monochrome graphic with printer port*	25
ML/CGP *Color graphic with printer port*	28
MaxLogic Auto EGA *EGA autoswitch, 256K RAM, 800x600*	79
Great Tek VGA *VGA, 16Bit, 256KB/512Exp. RAM, 1024x768*	109
ATI VGA Wonder/256 *VGA, 16Bit, 256KB RAM, 1024x768, OEM*	179
ATI VGA Wonder/512 *VGA, 16Bit, 512KB RAM, 1024x768, OEM*	199



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Panasonic 1191
240cps, 80 col., 9-pin 219

Panasonic 1124
192cps, 80 col., 24 pin 279

Panasonic 1624
192cps, 132 col., 24-pin 349

Panasonic 4420
Laser, 8pp. per minute, 22 fonts 899

Panasonic 4450i
Laser, 11pp. per minute, 28 fonts 1299

Panasonic 4455 PostScript
Laser, 11pp. per minute, 39 fonts ..... CALL

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144cps, 80 col, 9-pin 159

Star NX1000 Rainbow
144cps, 80 col., 9-pin 199

Star NX1500
192cps, 132 col., 9-pin 279

Star XR1000
300cps, 80 col., 9-pin 299

Star XR1500
300cps, 132 col., 9-pin 409

Star XB2410
240cps, 80 col., 24-pin 429

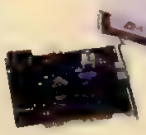
Star XB2415
240cps, 132 col., 24-pin 549

Modems

CARDINAL TECHNOLOGIES INC

HYUNDAI

STAR



1200 Internal
1200/300 Baud Internal 47

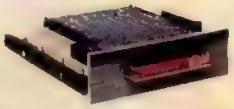
2400 Internal
2400/1200 Baud Internal 75

2400 External
2400/1200 Baud External 89

All modems are Hayes compatible and come complete with user documentation. Internal models include terminal software.

Tape Back-Ups

COLORADO MEMORY SYSTEMS INC



Colorado 60
60/40MB Internal, half-height 245

Colorado 500
500MB Internal, half-height, w/host adapter 989

Tape Back-Ups come complete with data compression and back-up software. PS/2 Kit Add $69. External Kits Add $125. Tape Adapter Cards Add $69.

Chips & Co-Processors

intel

Intel 8087-3
5Mhz for XT systems 87

Intel 8087-2
8Mhz for XT systems 119

Intel 8087-1
10Mhz for XT systems 149

Intel 80287-6
6Mhz for 286 systems 119

Intel 80287-8
8Mhz for 286 systems 187

Intel 80287-10
10Mhz for 286 systems 209

Intel 80387-SX
SX for 386 systems 279

Intel 80387-16
16Mhz for 386 systems 299

Intel 80387-20
20Mhz for 386 systems 349

Intel 80387-25
25Mhz for 386 systems 445

Intel 80387-33
33Mhz for 386 systems 549

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Mice & Software

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Genius GM-6X
3 Button, 200-800 DPI w/Dr. Halo 20

Genius GM-6000
3 Button, 350-1050 DPI w/Dr. Halo 35

Genius GM-F302
3 Button, 350-1050 DPI w/Dr. Genius 47

Genius GeniScan
400 DPI, Bus Card w/Dr. Genius 159

System Componentry

Motherboards

ML/XT-12
4.77-12Mhz, Turbo Motherboard w/CPU 59

ML/286-12
12Mhz, 4MB EMS Motherboard w/CPU 129

ML/386-16SX
16Mhz, Neat-SX Motherboard w/CPU 329

ML/386-20SX
20Mhz, Neat-SX Motherboard w/CPU 499

ML/386-25
25Mhz Motherboard w/CPU 639

ML/386-25 Cache
25Mhz, 64KB Cache Motherboard w/CPU 799

ML/386-33Cache
33Mhz, 64KB Cache Motherboard w/CPU 999

ML/486-25
25Mhz, Cache Motherboard w/CPU 2499

All MicroLab Motherboards come with comprehensive user documentation and set-up utilities.

System Componentry

System Cabinetry

ML-XT Case & Power Supply
XT Slide, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 150W Power Supply 69

ML-Baby AT Case & Power Supply
Baby AT, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 89

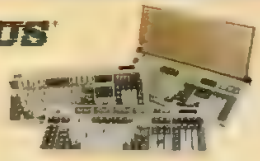
ML-PS/2 Case & Power Supply
PS/2, Slim Workstation, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 95

ML-Mini Upright Case & Power Supply
Mini Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply 99

ML-Full Upright Case & Power Supply
Full Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 230W Power Supply 175

MicroLab system cases are ergonomically styled, two-tone units and come complete with speaker, generous expansion parts supply and 4-lead power supplies.

FOCUS



Keyboards

Focus FK-2001
101-Key, true tactile "click" response, mechanical Alps switch, hinged dust cover/copy holder 49

Focus FK-3001
111 Key, true tactile "click" response, mechanical Alps switch, built in solar-powered calculator 59

Focus FK-5001
130-Key, true tactile "click" response, mechanical Alps switch, built-in battery operated calculator, both top and left-side 12-key function key layouts, keyboard templates and holder, turbo switch 79

Add-On Cards

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Dual Floppy Disk Controller 15

AT I/O
Parallel, Serial & Game Ports 19

XT Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 29

FDC-2 Multi
Two FDC (360/1.2/720/1.44) 29

FDC-4 Multi
Four FDC (360/1.2/720/1.44) Combo 39

XT High Density Multi I/O
Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports 59

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OUR CONTRIBUTORS

Alan Cohen is an assistant production editor at *PC Magazine*. **Carol Levin** and **Tom Unger** are staff editors of *PC Magazine*. **Gregg Keizer** is a Louisiana-based free-lance writer. **Alfred Poor** and **M. David Stone** are contributing editors of *PC Magazine*. **Emerson A. Torgan** is an editorial assistant at *PC Magazine*. **Donald P. Willmott** is an associate editor of *PC Magazine*.

client names and information into a useful database to help you communicate more effectively with your clients, customers, and sales prospects.

Eighty/20 Advanced

by Alfred Poor

The old time-management adage teaches us that a 20-percent investment in planning will yield an 80-percent reduction in the amount of time it takes to complete a job. *Eighty/20 Advanced*, a $395 package from Eighty/20 Software, aims to save you time and effort, whether you are in sales or not.

Eighty/20 comes with the features you expect to find in a contact manager and uses a text-based interface (a bit cluttered at times) to display them. There is a batch of six user-defined fields that reside on a secondary screen, and it is not immediately obvious that they exist or how to find them.

CONVENIENT FEATURE SET

Features include the typical phone dialing (only two phone numbers per contact) and mail-merge functions. You can schedule events and keep notes on the activities. There are even appealing extras such as expense tracking and lookup tables for data entry, with context-sensitive help available for many screens. The program makes it easy to maintain a history of past actions.

There are some unusual features as well. For people involved in sales or research calls, there is a sophisticated call-scripting feature. Some programs can pop-up a list of common questions and show you the responses, but *Eighty/20* goes much further. You can build complex branching scripts, and the program will record the answers and choices taken at each juncture. Not only that, but the program will even time the length of the call so you can track how long the interviews are taking on average.

You also get automatic look-up of city and state based on ZIP codes—only a few ZIP codes are loaded when you first get the program, but the list grows automatically as you add new database records.

STRUCTURAL SHORTCOMINGS

Based on *Clipper* code, *Eighty/20* uses *dBASE III* data files. While this might seem to be an advantage, it is not. Not only does *Eighty/20* Software not include any documentation of the file structure, there is no data import or export facility aside from printing a report to disk. If you want to move your data around, you need to get the Data Conversion Utility, a $50 option.

One curious fact about the file structure is that there are not separate fields for first and last names for each contact. As a result, you cannot search for a person by their last name except by searching within the entire name field. There is a "Salutation" field that can be used for first names, but in some cases you will want to address someone more formally with a title and last name, so you can't count on using this as a first name field.

The weakest parts of *Eighty/20* are the user interface and the printer support. The program does support a variety of printers, including laser printers, but the font support is primitive and the word processing features are spartan at best. The output is more convenient than a typewriter, but you'll have to forego the use of proportional fonts or other fancy formatting that you expect from most word processors.

The documentation is hefty and a bit ponderous in its style, but it is thoroughly indexed and serves well as a reference. The program is sleek enough to fit on a pair of 3.5-inch floppy disks (or a pair of high-density 5.25-inch disks) which makes

Eighty/20 Advanced **offers a variety of reports as standard features. From this screen, you can print envelopes, labels, and mail-merge letters, as well as different list formats.**

Eighty/20 Advanced

SUITABILITY TO TASK

Information management/ scheduling	■	■	3	
Mail-merge/ word processing	■	■	3	
Report generation	■	■	3	
Portability	■	■	3	

FACT FILE

***Eighty/20 Advanced*, Version 2.23**
Eighty/20 Software, 126 West Rock St., P.O. Box 3128, Mankato, MN 56002; (800) 635-8020, (507) 345-8020.
List Price: $395; network version, $995.
Requires: 460K RAM, DOS 2.0 or higher; for multiuser, DOS 3.1 or higher. Hard disk recommended.
In Short: Aside from some sophisticated script capabilities, *Eighty/20 Advanced* fails to stand out from the rest of the pack. More than adequate for many tasks, the package is less complete than competitors like *Act!* and *Sales Ally*.

CIRCLE **402** ON READER SERVICE CARD

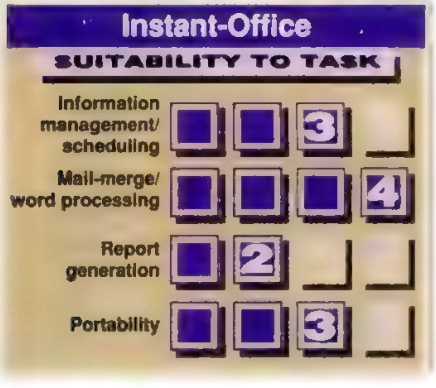
it possible to run on most portables.

Eighty/20 is an adequate performer, but the lack of built-in import and export features and the small number of fields offered make it less attractive than some competitors. The call-scripting feature is perhaps its most distinguishing feature. Unless this is a swing factor in your decision, you will probably do better with something else.

Instant-Office

by Alfred Poor

Instant-Office from Dilworth Software is a $199 program that helps you manage names, addresses, correspondence, telephone calls, appointments, and more. This package also poses a challenge to a reviewer because it contains a mixture of features that vary greatly in their utility and quality of implementation.



Part of this inner conflict arises from the way the program is developed. The publisher issues frequent updates, primarily to add new functions, but these often result in changes in the way the program operates. A quote from the second page of the manual says it all: Since the program is updated more frequently than the manual, if you find a conflict in the directions, believe the screen before you believe this manual.

One problem with this disclaimer is that not everything appears on the screen. Many features are hidden, such as the four-function calculator available in the data-entry screen; the only place to find it mentioned is in the context-sensitive help screen.

On the other hand, the program is filled with brilliant touches. The most fundamental feature is its word processor—it has none. Rather than require you to give up your favorite word processor, it is designed to use any one of several major word processors as a seamless part of the program: *WordPerfect, WordStar, XyWrite, Volkswriter, Microsoft Word, Nota Bene, Professional Write, QS,* and *NewWord.* Limited support is provided for a handful of other programs.

The way this works is simple. Whenever you need to use a word processor, *Instant-Office* shells out to DOS and unloads most of itself from memory and then calls your word processor. If you're taking notes on a client, it calls up a document that is linked to that client's record. This gives you unlimited capacity for notes, plus all the search, formatting, and macro facilities offered by the word processor. Or you can call up a client's data screen, press three keys, and your word processor will load with a letter already started—date, name, address, salutation, and a closing signature block with your name. If you want, you can even create a letterhead file with your word processor that will be merged automatically when the letter is created.

This approach does have its limitations, however. For example, *Instant-Office* uses your word processor to maintain a to-do list. Unlike other programs where this list is automatically updated with information from each individual contact record, *Instant-Office* requires that you keep to-do tasks in a static word processing document.

There are other limitations. You can only schedule one event per contact, although the latest version of the program makes this far easier than it was in prior versions. There is no calendar—you can get a list of events scheduled for a day, or a range of days (the default is a week starting with today). There are many useful reports, with lots of variations and options, but there is no free-form report facility. (There is an optional Query module for $150 that provides more reporting power.) There are no user-defined fields.

FACT FILE

Instant-Office,
Version 3.93
Dilworth Software Inc., 24321 San Juan Rd., Box 1495, Carmel, CA 93921; (408) 624-6500.
List Price: $199; network version, $695 per server.
Requires: 256K RAM (384K or more recommended), 700K available disk space, DOS 2.1 or later.
In Short: *Instant-Office* is constantly changing and full of features, but there are some rough edges. Its best feature, however, is that it uses your word processor for letter-writing and notes, giving excellent output quality and unlimited storage capacity.

CIRCLE **403** ON READER SERVICE CARD

INCONSISTENT INTERFACE

The program interface is not consistent between functions. There is a moving light bar on the first screen of the main menu, but not the second. The data entry screen is crowded, and cursor movements are not intuitive. The program was developed using *DataFlex* and is generally reliable and robust, but the excellent data import module is flawed by a bug that allows you to consistently crash it. And another bug causes the program to lose track of a contact's note file if the person's last name changes. According to a com-

Instant-Office **includes one of the simplest data import facilities of all contact managers: It lists a record's data from your source file on the left half of the screen, and the target fields on the right. You simply rearrange the fields on the right so that they line up with your data.**

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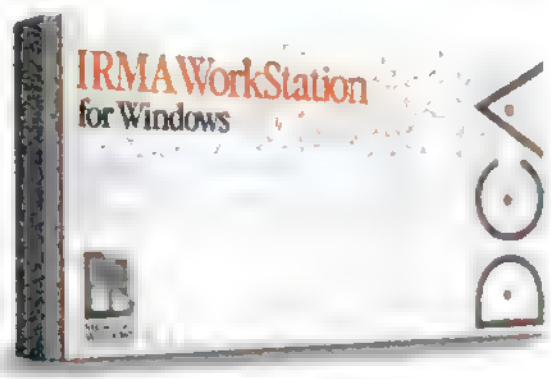
It's easy. Just take a deep breath. Close your eyes, if you feel like it.

And jump.

DCA



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CIRCLE 278 ON READER SERVICE CARD

be fixed in a future upgrade.

But there is also much to love about this package. It is arguably the easiest one to use for one-time letters, and it makes envelope and label printing a snap, even one at a time on a laser printer. It can fit on a single high-density floppy disk (although the company recommends that you use a hard disk) so it can be used with a notebook computer. It recognizes calls within your area code, toll calls, and calls that require a "1-" prefix. You can duplicate one contact record to create a new one for someone else in the same company. The category field provides simple but powerful and flexible search facilities. There is comprehensive fax board support. And you get to use the word processor you already know, which means you can use all its font and formatting features to produce attractive letters.

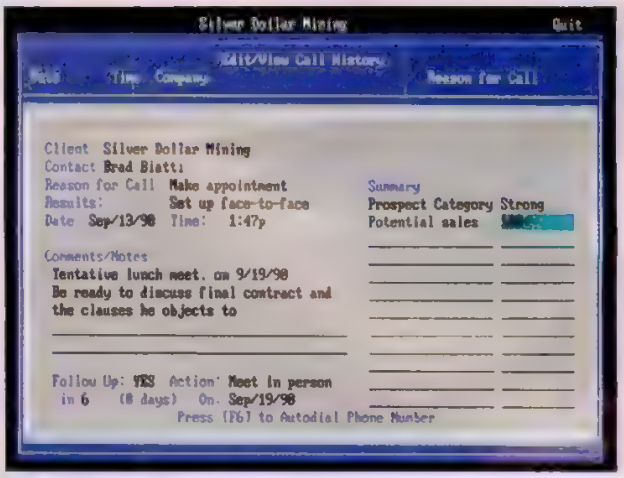
In the end, you must decide for or against *Instant-Office* based on your needs and tastes. It is missing some sophisticated features offered by more expensive programs, and covers the basic features with an uneven interface. It is ideal for use with lasers, printing all sorts of labels and envelopes with ease. And the power offered by integrating your existing word processor saves you money and training time, while giving you the best output quality of any package in this group.

Integrated Sales Manager

by Gregg Keizer

Integrated Sales Manager from ASELCO is a fast, no-frills contact manager that tries to automate sales and telemarketing chores. *ISM*'s great advantage is speed; it plows through large numbers of contacts with a RAM-based contact list. This package costs $495 and is the best choice for portable-equipped sales staffs who are just beginning to benefit from a down-and-dirty, information-in, information-out alternative to a DayTimer. Its bare-bones approach makes it a natural to first-time computer users.

ISM's interface provides seven selections across a single menu bar: Database, Calendar, Things, Report, Features, Back-Up, and Program. The menus pop down like those in *Microsoft Windows*, and submenus overlap previous windows or appear to the side. You won't have any problem [illegible] *ISM*'s screens, although [illegible] lacks important keyboar[illegible]stance, there's no way to [illegible] field on a contact screen without repeatedly hitting a cursor or Enter key. A contact spans three sparse screens that hold little more than the basics: company name, address, phone number, two contacts, and some sales-related data that can be customized.



***Integrated Sales Manager*'s Sales Call feature works well at structuring sales calls and tracking sales progress.**

TOO MUCH MISSING

You'll find traditional and unusual supporting features in *ISM*. The calendar, expense tracker, and memo writer are solid—not flashy. The alarm feature works only within the program, and its quirks may stump you at first. Built-in invoice and quotation writers are useful if they are part of your job, but these features will [illegible] the contact database puts meager screens on the monitor, you can easily organize and reorganize your contacts. Selecting a list of contacts that meet your criteria from a maximum of 1,500 held in RAM is fast and simple. From there you can pigeonhole contacts by group or database, a term *ISM* uses to describe a user-defined subsection of the contact list.

One of *ISM*'s brightest spots is the Sales Call feature. This tool lets you record calls and summarize the phone pitch via a custom response list. It's perfect for guiding you through an over-the-phone sales presentation.

Stripped down as it is, *ISM* is missing more than it offers. Don't expect data import or export, on-line help, or even user-defined reports. You'll use *ISM*'s memo writer only as a word processor of last resort. It doesn't insert the contact name and address, and it handles only the most elementary editing and formatting. You can't write a contact note longer than 781 characters and only one phone number can be auto-dialed per contact. Add a stronger appointment calendar and a new to-do list, toss the invoice/quotation features, and *Integrated Sales Manager* would fare better against the competition. But nothing's going to help until the anemic contact database gets more screens, more fields, and more features.

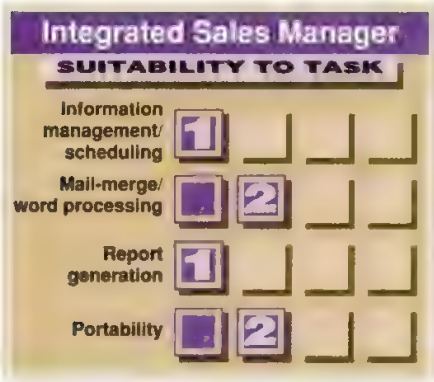
FAST AND SINGLE-MINDED

Comparisons with other contact managers highlight *ISM*'s deficiencies even more. Although *ISM* shares strong list management traits with packages such as *The Maximizer*, it's simply not in the same league. Telemarketers will want to head for beefier programs and nonsales users

FACT FILE

***Integrated Sales Manager*, Version 2.0**
ASELCO Ltd., P.O. Box 251, Station S, Toronto, Ontario, M5M 4L7, Canada; (416) 391-2277.
List Price: $495.
Requires: 640K RAM, DOS 3.3 or later. Hard disk recommended.
In Short: *Integrated Sales Manager* is a fast but basic contact manager with few extras. Not appropriate for the general user, *ISM* is heavily sales oriented and specializes in telephone sales support. Its contact database offers a minimal number of fields, and its word processing and mail-merge are weak. Only limited sections can be customized.

CIRCLE 404 ON READER SERVICE CARD



will find little value here.

Strangely enough, the lack of features is *ISM*'s strongest suit. Salespeople who think a package like *Act!* is too much to handle may appreciate *ISM*'s back-to-basics approach. Sales-specific features, such as the customizable call response list, pinpoint the audience *ISM* is trying to reach. Fast though it is (and it is very fast), *ISM* is so set on courting the first-time computer user that it pales in comparison with programs that cost $100-$200 less.

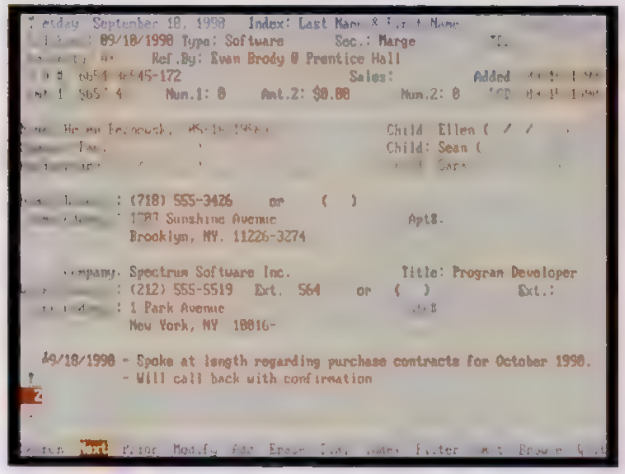
Salespeople with limited contact information needs or those spooked by feature-rich programs and large manuals may appreciate *ISM*'s many sales-specific features. However, if you're not in sales or if you expect much more than a simple database, *ISM*'s not for you. Too many important supporting features are absent. Look at *ISM* only if you keep the most basic contact information in your quest for the top prospect and the easy sale.

KeepTraX

by Alan Cohen

KeepTraX, a contact manager from O.T. Software, was designed for the telephone-based salesperson and no one else. Data fields are set in stone, features tend to veer toward simplicity, and the company's definition of state-of-the-art is somewhat behind the times.

KeepTraX is equalled by other packages in its general price range, and is far surpassed by programs in the $300 to $400 range (such as *The Maximizer*). Still, *KeepTraX* shows flashes of potential, and users who can live with its limitations may want to take a look.



KeepTraX's File-Folder mode is where you enter information and comments on a contact. None of the data fields are customizable.

CREATING FILE FOLDERS

KeepTraX stores data in a two-screen format called a file-folder. The main screen displays general information (name, phone number, address, title, name of spouse, date of last call, and so on) concerning a specific client or contact. The second screen consists of a comment field. All file-folders are stored in a single database, and the program will alert you when a duplicate record is entered. While the package allows for quick exits to DOS, you won't be able to do much there. *KeepTraX* is not a TSR and uses 512K RAM. Users working on 640K systems will find they have to quit *KeepTraX* entirely to run a second application.

The *KeepTraX* interface is colorful and easy to use. Two forms of on-line help are provided (General and Detailed) and help screens can be customized. Command options are displayed at all times, so there is never any confusion over which button to press.

The package also offers a notepad, an appointment scheduler, a calculator, and an important-dates database (to store birthdays and anniversaries). While all of these features are simple to use and are accessible by a single keystroke, each one is remarkable only for its unremarkableness.

The calculator is limited to the four basic arithmetic operations; the notepad can hold, at most, three lines of text per note; and the appointment scheduler has only rudimentary search capabilities—you can search appointments by date, month, or year, but not by name. You can search for all meetings scheduled for October, but not for all meetings scheduled with Bob Smith. When you're on the phone with Bob Smith, this can be a drawback.

A TOUGH WORKOUT

The overwhelming problem with *KeepTraX*, however, is its rigid design. The data fields in the file-folders have been set by O.T. Software and cannot be changed. This is fine as long as you wish to store the same information O.T. thinks you want to store. If you don't, you're out of luck.

On the other hand, if you can live with

FACT FILE

***KeepTraX*, Version 2.08**
O.T. Software Inc., P.O. Box 828, El Segundo, CA 90245; (213) 640-1700.
List Price: $149.95.
Requires: 512K RAM, DOS 2.1 or later. Hard disk recommended.
In Short: *KeepTraX* is a low-priced contact manager aimed specifically at telephone-based salespeople. While the package shows potential, particularly in its multiple-field searching capabilities, its uncustomizable data fields are a big drawback.

CIRCLE 405 ON READER SERVICE CARD

...macrocomputers.

Many industry observers still see OS/2, with its inherent multitasking functionality, as the eventual PC standard. F... appeal

Computer Systems News, May 28, 1990

...den in design... complex applications ... OS/2 will become a more attractive option for the future as users learn to take better advantage of its multitasking, enhanced de-

PC Week, August 13 1990

...ture. And ... software developer knows that it will need to migrate to OS/2 eventually.

PC Magazine, September 11, 1990

users will choose ... OS/2 Presentation Manager will be the strategic environment that will carry PC users into the next century. ...

PC Magazine, September 11, 1990

...give up a thing to do it. Eventually, we need OS/2 ...d all the power and safety the ...rating system brings.

Will Fastie, *The Fastie Report*, May 31, 1990

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"Eventually" is here.

Announcing The OS/2 You've Been Waiting For.

For quite some time, the press has been writing about the move everyone will want to make to OS/2.® Eventually. Well, all at once OS/2 1.3 has made OS/2 the operating system it was meant to be—the one you'll want to move to right here and now.

OS/2 Loses A Little Weight.

For starters, OS/2 has lost some of its appetite for memory. In fact, now you can make the move to OS/2 1.3 with as little as two megabytes on your system. What's more, this streamlined version leaves more room for applications and will offer some users a substantial performance increase in many system functions.

Functionality. Functionality. And Did We Mention Functionality?

Multitasking. Seamless connectivity. The ability to run applications larger than 640K. DOS® compatibility. All these features have made OS/2 appealing in the past, but new features have catapulted OS/2 into the here and now.

For instance, now OS/2 1.3 harnesses the power of Adobe Type Manager™ (ATM™). With this new feature, the quality of screen fonts has improved dramatically, giving you a true WYSIWYG capability so what you see is indeed what you get. ATM also gives OS/2 more flexibility in document creation by supporting a wide range of outline fonts.

Of course, what good is all this without printer support? Not much. So OS/2 1.3 has improved and expanded its printer support to include drivers for almost all popular printers.

Business Is Booming.

Now that OS/2 is moving forward, so are software developers. Every day, more and more applications are joining the growing pool of available OS/2 software. In fact, a variety of major business programs, including Aldus® PageMaker,® Lotus® 1-2-3/G® and Microsoft® Excel, have already made the transition to OS/2. These, along with many others, have been redesigned to go beyond DOS memory limits and take advantage of OS/2's intuitive graphical interface—Presentation Manager.™

It's been said that eventually you'll want to take advantage of everything OS/2 has to offer. Well, wait no more because "eventually" is here.

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OS/2 can do!

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CONTACT MANAGEMENT SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Business Contacts and Information Manager	ProSell	KeepTraX	Biz*Base Gold	SalesPro	Instant-Office
List price	$69.95	$149.00	$149.95	$175.00	$195.00	$199.00
Site licenses available	❑	■	❑	■	■	■
Network version	■	■	❑	■	❑	■
Network pricing	$695	$495	N/A	$600 (4 users), $400 (each additional 4-pack)	N/A	$695 per server (multiuser version)
Can use mouse	❑	❑	❑	❑	❑	❑
STANDARD SCREENS						
Maximum number of databases	1	100	1	1	Unlimited	1
Maximum number of records per database	Unlimited	Unlimited	Unlimited	1 billion	Unlimited	1 million
Fields included for:						
Country code	❑	❑	❑	❑	■	■
E-mail carrier	❑	❑	❑	❑	■	❑
Fax number	❑	❑	❑	■	■	❑
ID number	■	❑	■	❑	■	■
Last action taken	❑	■	■	❑	■	❑
Referred by	❑	❑	■	❑	■	❑
Can customize all fields	❑	❑	❑	❑	■	❑
Fields can be hidden	❑	❑	❑	❑	❑	❑
Sort/search by:						
Company	■	■	■	■	■	■
First letter	■	■	■	■	■	■
First name	■	■	■	■	■	■
ID number	■	❑	■	❑	■	■
Key word or string	■	■	❑	■	■	■
Last name	■	■	■	■	■	■
Multifield queries (and/or)	■	■	■	■	❑	■
Phonetically	❑	❑	❑	■	❑	❑
Zip code	■	■	■	■	■	■
Zip code range	■	❑	■	■	■	■
Can save queries	■	❑	■	■	■	❑
Can recognize duplicate entries	■	❑	■	❑	■	■
Can attach notes to records	■	■	■	■	❑	❑
Maximum size of note	Unlimited	64K	Unlimited	16K	❑	Unlimited
Can cut and paste notes	❑	❑	❑	❑	❑	❑
Default database file format	None	.DBF	.DBF	.DBF	Comma-delimited	*DataFlex*
Database import/export	❑	■	■	■	■	■
Import/export formats	None	.DBF	ASCII, .DBF	ASCII, comma-delimited, .DBF	.DBF	ASCII, comma-delimited, .DBF, .DIF, *XyWrite*
Can purge historical records by date range	■	❑	❑	❑	❑	❑
Phone dialer	■	❑	■	■	■	■
Maximum number of phone numbers per contact	2	2	4	4	Unlimited	3
Can handle dial prefix of any length	❑	❑	■	❑	❑	■
Automatic redial	❑	❑	❑	❑	❑	❑
Automatically recognizes local number	❑	❑	■	■	❑	■
Automatically adds area code to local numbers when dialing from the field	❑	❑	❑	❑	❑	❑
Time and date stamp	❑	■	■	■	❑	■
Number of customizable fields allowed	10	8	None	29	Unlimited	None

❑—Editor's Choice ■—Yes ❑—No
N/A–Not applicable: the product does not have this feature.

The Maximizer	Act!	Eighty/20 Advanced	Sales Ally	Integrated Sales Manager	Action Plus	TeleMagic	TeleSell	Pursuit
$295.00	$395.00	$395.00	$395.00	$495.00	$495.00	$495.00	$695.00	$795.00
■	❑	■	■	■	■	■	■	■
■	❑	■	■	❑	■	■	■	■
$695	N/A	$995 per server	$895 (2-user system), $1,495 (3 or more users)	N/A	$1,495	$1,995	$1,995 (4-user version)	$1,895
❑	■	❑	■	❑	❑	❑	❑	❑
1	Unlimited	1	Unlimited	1	Unlimited	Unlimited	Unlimited	Unlimited
Unlimited	Unlimited	99,999	Unlimited	1,500	99 million	1 billion	Unlimited	Unlimited
■	■	■	■	❑	❑	❑	■	❑
❑	■	❑	❑	❑	■	❑	■	❑
■	■	❑	■	■	■	■	■	■
■	■	■	■	❑	■	❑	■	■
■	■	❑	■	■	■	■	■	■
■	■	❑	❑	■	❑	■	■	■
■	■	❑	❑	❑	❑	❑	■	❑
■	■	❑	❑	❑	❑	❑	❑	❑
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	❑	■	■	■	■	■
■	■	■	■	❑	■	❑	■	■
■	■	■	❑	■	■	■	■	■
■	■	■	■	■	■	❑	■	■
■	■	■	❑	■	■	■	■	■
❑	❑	❑	❑	❑	❑	■	❑	❑
■	■	■	■	■	■	■	■	■
■	■	■	■	❑	■	■	■	■
■	■	■	■	■	■	■	■	■
❑	❑	❑	■	❑	■	❑	■	■
■	■	■	■	■	■	■	■	■
8K	Unlimited	Unlimited	46 (lines per screen)	781 characters	24K	64K	Unlimited	Unlimited
■	■	❑	❑	❑	■	■	❑	❑
Btrieve	ASCII	.DBF	*Btrieve*	None	.DBF	.DBF	*Btrieve*	*DataFlex*
■	■	❑	■	❑	■	■	■	■
ASCII, comma-delimited	ASCII, comma-delimited	None	Comma-delimited	None	.DBF	ASCII, .DBF	ASCII, .DBF, .DIF	Comma-delimited
■	■	■	■	■	■	■	■	❑
■	■	■	■	■	■	■	■	■
4	4	2	3	5	4	7	1	1
■	■	❑	■	■	■	■	■	❑
❑	■	❑	❑	❑	❑	❑	❑	❑
❑	❑	■	■	❑	❑	■	■	❑
❑	❑	❑	■	❑	❑	■	■	❑
■	■	■ (date only)	■	■	■	■	■	■
47	29	16	20	26	5	97	Unlimited	15

CONTINUES

CONTACT MANAGEMENT SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	Business Contacts and Information Manager	Pro$ell	KeepTraX	Biz*Base Gold	SalesPro	Instant-Office
Includes calendar	❑	❑	■	■	■	❑
Adjustable time scale	❑	❑	❑	■	❑	❑
Event alarm (buzzes when it's time to call)	❑	❑	❑	■	■	❑
Text search to find appointments	❑	❑	❑	■	❑	❑
Weekly appointment view	❑	❑	■	■	❑	❑
Monthly appointment view	■	❑	■	■	■	❑
To-do list	■	■	■	■	■	■
Can assign priority levels to tasks	❑	❑	❑	❑	❑	❑
Carries undone tasks to next day	■	❑	❑	■	❑	■
Can attach notes on to-do tasks	■	❑	❑	❑	❑	■
WORD PROCESSOR						
Text editor	■	■	■	■	■	❑
Spell-checker	❑	❑	❑	■	■	❑
Move or copy block	❑	❑	❑	■	■	❑
Search and replace	❑	❑	❑	■	■	❑
MAIL-MERGE						
Mail-merge/letter generator	■	■	❑	■	■	■
Can import boilerplate text	❑	❑	N/A	■	■	■
Can print header in correct place for window envelopes	❑	■	N/A	❑	■	■
Prints envelopes	■	■	N/A	■	■	■
Prints labels	■	■	■	■	■	■
FAX capability	❑	❑	❑	❑	❑	■
Can fax boilerplate text	N/A	N/A	N/A	N/A	N/A	■
Can delay transmission	N/A	N/A	N/A	N/A	N/A	■
REPORTS AND UTILITIES						
Number of predefined reports	10	16	11	14	9	6
Maximum number of user-defined reports	None	None	52	Unlimited	Unlimited	None
Can produce column math in reports	❑	❑	■	■	❑	❑
On-line area codes	❑	❑	❑	❑	■	❑
Spreadsheet	❑	❑	❑	❑	■	❑
Expense tracker	❑	■	❑	❑	■	❑
Macro facility	❑	❑	❑	❑	■	❑
Backup/restore facility	❑	■	❑	❑	❑	■
Calculator	❑	❑	■	■	■	■
SECURITY/HELP						
Password security	❑	❑	❑	❑	■	■
Context-sensitive help	■	❑	■	■	■	■
Tutorial	■	■	❑	■	❑	❑
Support hot line	■	■	■	■	■	■

❑—Editor's Choice ■—Yes ❑—No
N/A–Not applicable: the product does not have this feature.

this limitation, you'll find that *KeepTraX* is not without its strong points. A filter function allows you to create your own search criteria using Boolean logic. On-screen menus lead the way, so it's simple to use, and you can use the filter to create complex search criteria.

For example, if you want to search for every contact in the database who is a vice president, you select "title" as the field to search, "contains" as the comparison type, and "VP" as the value for comparison. In this way, *KeepTraX* will search for every file-folder that contains the term VP in the title field. The resulting set will include folders for Executive VPs, Senior VPs, and VPs of Engineering. This is by far the package's most-powerful feature.

Other features are useful but not spectacular. *KeepTraX* will also allow you to view contacts in column format. Up to 21 contacts can be viewed on-screen at one time, and for each contact, all 52 data fields can be accessed via the scroll keys. The package will also output information or labels to your printer. Here *KeepTraX* is flexible: you choose the information to be printed and how it should be grouped on the page (although you are still limited to those strict data fields). A recall function allows the retrieval of erased (but not permanently deleted) records, and a Pack command expunges data for all time. Appointments and notes can be archived to a floppy disk and retrieved at a later time to save hard disk space. An

The Maximizer	Act!	Eighty/20 Advanced	Sales Ally	Integrated Sales Manager	Action Plus	TeleMagic	TeleSell	Pursuit
■	■	■	■	■	■	■	□	■
■	■	■	■	■	□	■	□	■
□	■	□	■	■	□	■	□	□
□	□	□	□	□	■	□	□	□
■	■	□	■	■	□	□	□	□
■	■	■	■	■	■	■	□	■
■	■	□	■	■	□	■	■	■
□	□	□	□	■	■	□	■	■
■	□	□	□	■	□	□	□	□
□	■	■	■	■	■	□	□	■
■	■	■	■	■	■	■	□	■
□	■	□	Optional	□	■	□	□	□
■	■	□	■	□	■	■	□	■
□	■	□	■	□	■	■	□	■
■	■	■	■	■	■	■	■	■
■	■	□	■	■	■	□	■	■
■	■	□	□	□	■	■	■	■
■	■	■	■	□	■	■	■	■
■	■	■	■	□	■	■	■	■
□	□	□	□	□	□	□	■	■
N/A	N/A	N/A	N/A	N/A	N/A	N/A	■	■
N/A	N/A	N/A	N/A	N/A	N/A	N/A	□	□
23	9	12	27	11	20	19	22	55
Unlimited	Unlimited	Unlimited	Unlimited	None	20	Unlimited	Unlimited	Unlimited
□	■	□	□	□	■	■	■	■
□	■	■	□	□	□	□	□	□
□	□	□	□	□	□	□	■	□
■	■	■	■	■	■	□	□	□
■	□	□	■	□	□	■	■	□
□	□	□	■	■	□	■	□	□
■	■	□	■	□	□	■	■	■
■	□	■	■	□	□	■	■	□
■	■	■	■	□	□	■	■	□
■	■	□	■	□	□	■	■	□
■	■	■	■	■	■	■	■	■

ENDS

on-board text editor is also provided, but don't look for any mail-merge features.

KeepTraX can also read data created in other packages. The program can import .DBF, fixed-length ASCII, and variable-length ASCII files. On our tests, we encountered one small problem when importing .DBF files: some data was lost when an imported field was longer than its corresponding *KeepTraX* field.

There are contact managers far more flexible than *KeepTraX*, and its desktop utilities could use beefing up. Like a minor-league baseball player, *KeepTraX* shows signs of potential, but it's still not ready for the majors.

The Maximizer

by Gregg Keizer

The Maximizer integrates an impressive set of sales and contact tools with a database that can file an unlimited number of clients, contacts, and alternative phone numbers under any single organization. This $295 program from Richmond Software works fast, whether it's opening client-information windows or searching for a specific contact, and lets you customize sublists of all kinds from the contact database. *The Maximizer* serves remarkably well as a salesperson's primary application.

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3220 ☐ DESQView 2.3..... 79.
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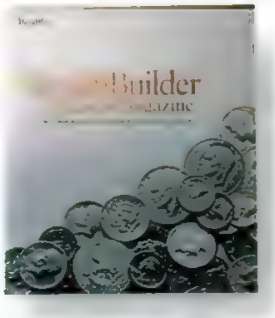

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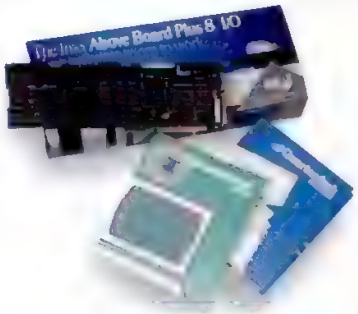

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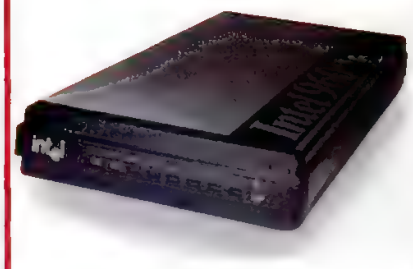

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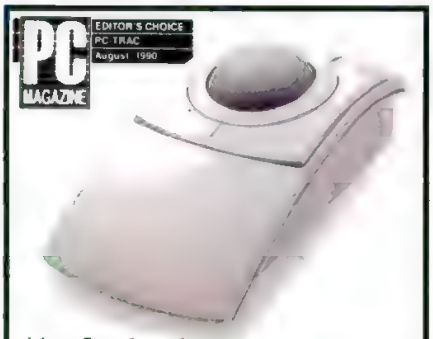

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Mountain Computer ... 2 years

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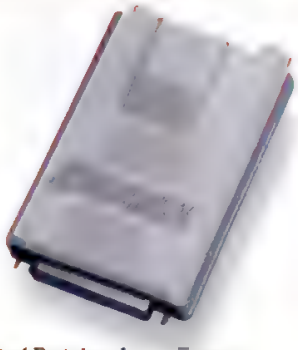
5500	80-152M Int. Tape Drive	629.
5502	83-152M Ext. Tape Drive	799.
5190	DC2000 Pre-formatted Cartridges *ea.*	35.
6153	DC2120 Tape Cartridge *(5 pack)*	135.



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6602	1.44 External *(for PC/XT/AT)*	239.

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7103	ST251-1 Model 30 *(w/controller)*	339.
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3292	5¼" DS/HD 1.2Mb Disks *(Qty. 10)*	19.
3297	3½" DS/DD 720k Diskettes *(Qty. 10)*	13.
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complex functions via hierarchical pop-up menus. Information can get buried beneath several menu levels, but reaching a client takes just four keystrokes. The pop-up screens are clean and uncluttered. Major credit goes to the secondary windows that underlie the client screens and contain additional contacts, important dates, and notes. Fields in the contact windows range from the standard name and addresses to a maximum of four phone numbers, and you can easily change any field name. *The Maximizer*'s interface is simple to use and quickly guides you to the contact you want. However, the program doesn't make use of a mouse.

AUTOMATIC TO-DO LIST

The Maximizer's client/contact database structure lets you group as many contacts under a single client as you want. In *Maximizer* parlance, a client is an organization, company, or department, while a contact is one individual in that organization. It's perfect when you have multiple contacts at one company and want to trace the contact history for each one separately.

The program also includes the standard telephone support—auto-dialing, automatic phone log, and timer—as well as a minimal word processor for correspondence, a flexible daily calendar, a diary, and basic income/expense entry. One feature of special interest is *The Maximizer*'s Hotlist, which automatically combines all Next Contact dates with the names and entries from the defined range of your day-at-a-glance calendar entries to create a super to-do list.

Although *The Maximizer* covers the basics, and much more, it lacks minor features such as an appointment alarm and a single-screen summary of actions and results for each contact. In *The Maximizer*, you must switch between two windows to see the complete details of your dealings with a contact. Although you can organize the database in an almost limitless number of ways, you're restricted to the one database. This prevents you from developing smaller, more-focused contact lists for specific and perhaps temporary tasks. It also makes it difficult for a small sales staff to comfortably share one *Maximizer*-equipped computer.

Database import and export is also limited. Only ASCII files in comma-delimited format can be imported. It takes two export/import cycles to merge two *Maximizer* databases, and even then things such as the accompanying notes are not carried over.

BROAD-BASED APPEAL

The Maximizer looks good regardless of the contact manager you compare it with. It's not as keystroke savvy as *Act!*, and it doesn't offer as many pop-up lists to speed data entry, but its automatic Hotlist greatly simplifies to-do list compilation. There's no dedicated telemarketing script feature like the one found in *TeleMagic*, but the general phone support, including auto-dialing and automatic call logging, is good. *The Maximizer*'s macro creation is another unusual and welcome addition to the contact management arena.

The Maximizer's simple operation will appeal to phone-bound salespeople who don't need distractions from their software. Nonsales users who work with a large number of contacts or need to track multiple contacts within an organization will appreciate *The Maximizer*'s speed and capacity for unlimited contacts. *The Maximizer* is a well-rounded program, one that satisfies every major contact management need.

FACT FILE

***The Maximizer*, Version 2.0,** Richmond Technologies & Software Inc., 420-6400 Roberts St., Burnaby, BC V5G 4C9, Canada; (609) 299-2121.
List Price: $295; network version, $695; upgrade from single-user to LAN version, $395.
Requires: 512K RAM, hard disk, DOS 2.1 or later.
In Short: *The Maximizer* is an easy-to-use contact manager with a fast database, impressive sales support features, and a to-do list compiler that simplifies follow-up call and appointment scheduling. However, it restricts you to one database, and merging several users' contacts is awkward.

CIRCLE 406 ON READER SERVICE CARD

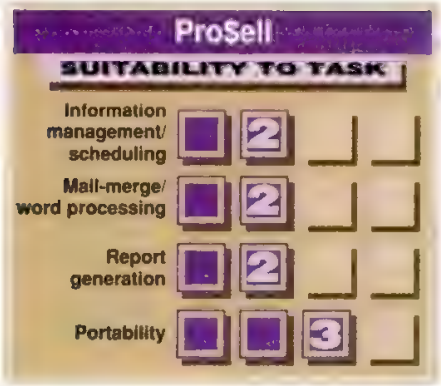
The Maximizer stores an unlimited number of contacts under each company or a client umbrella.

Pro$ell

by M. David Stone

Promoted as the program "for sales professionals on the move," *Pro$ell* from Sales Management Systems is tightly focused on the needs of the traveling salesperson. As you would expect, this direction limits the program's usefulness for other applications. *Pro$ell*, Version 1.9, would be a poor choice for telemarketing or fund raising, but at $149 per user and with site licenses available, the program does a good job of serving the salesperson on the go.

Sales Management Systems has



designed *Pro$ell* for use at odd moments throughout the day—in a car between appointments, for example. It is easy to learn and use, with menus and data-entry screens that are largely self-explanatory. The choices on the main menu include Setup, Client Files, Sales Reports, Expense Entries and Reports, Utilities, Mailing Lists, Reports, and Labels. You make a selection by typing the first letter of the menu choice or highlighting the choice and hitting Enter.

The fully descriptive menu choices make the program's internal logic clear, so that even a newcomer can find any feature. There is no on-screen help, but there is also little need for it. The manual is notable for being short, well-written, and to the point.

INDEPENDENT DATABASES

Not surprisingly, you'll find some features that are of particular interest for outside sales: expense tracking, a report for listing clients by street within a ZIP code, and fields that show hours of operation for each day of the week.

Pro$ell's focus is emphasized by the way it handles sales territories. It allows up to 100 databases, with each database consisting of one territory. Except for a feature that lets you reassign a contact record to a different territory, these databases are independent. The benefit here is that each salesperson can maintain a territory database on a portable computer while on the road. A sales manager can then update a system simply by copying the latest files from any salesperson's computer. The drawback is that there is no way to produce reports that include more than one territory.

Given the reality that hard disks are not yet prevalent in portable systems, Sales Management Systems has wisely chosen to keep the program's size down to a minimum. Unlike programs such as *Tele-Magic*, which uses about 1MB of disk space, *Pro$ell* easily fits onto one 720K floppy disk with about 310K to spare. According to the manual, a system with one 720K floppy disk drive will have room for about 350 client records. A system with two 720K floppy disk drives will have room for about 500.

IMPROVEMENTS TO COME

Pro$ell has some notable limitations. As shipped, the client record has room for only three contact names and two phone numbers, and it isn't customizable. The client screen comes with about 20 fields, eight of which allow you to change the name. There is no way to add more fields.

Other limitations show up in the text editor, which lacks basic functions like block move, and in the mail-merge feature it's limited to inserting the address and salutation. Finally, the notes feature has a date stamp with no time stamp and allows only one line of text for each note. The export feature is limited to generating CSV format files for mail-merge with a word processor. Import, which is also limited to CSV format, is a $45 option.

Extras, such as an appointment calendar, phone dialer, and password security are missing. According to Sales Management Systems, a calendar, phone dialer, additional fields, improved text editor, a hotkey to DOS, and multiline notes with a time stamp will be added in the upcoming *Pro$ell Plus*. This version became available in October, but was released too late for evaluation here. *Pro$ell Plus* will also be available in a $495 network-based version called *Pro$ell LAN*.

Pro$ell is best described as a minimalist package that includes features sufficient in most cases. If your organization has the luxury of portable PCs equipped with hard disk drives, you'll want to look elsewhere. But as a tool to help salespeople keep track of contacts on floppy disk-based portables, *Pro$ell* is a very good choice.

The *Pro$ell* contact record shows the minimalist approach of the entire program. Note that the contact record itself, in the upper-left quarter of the screen, has only about 20 fields, while the notes on the bottom half of the screen lack a time stamp and are limited to one line per note.

FACT FILE

***Pro$ell*, Version 1.9**
Sales Management Systems Inc., 1420 N.W. Gilman Blvd., #2127, Issaquah, WA 98027; (800) 444-9945, (206) 391-0710.
List Price: $149.
Requires: 512K RAM, DOS 2.1 or later, hard disk recommended.
In Short: Targeted for traveling salespeople and designed to run on a single 720K floppy disk, *Pro$ell* offers such useful features as expense tracking and a separate database for each sales territory. Although some features, like the text editor, are minimal, and others like auto-dialing are missing entirely, the program is a reasonable choice for floppy disk-based portable use.

CIRCLE 407 ON READER SERVICE CARD

Pursuit

by M. David Stone

Pursuit, Version 2.2, from Information Management Consultants can function as a standard contact manager but is best described as an automated marketing package. The package's strongest point is its ability to define and follow a marketing campaign. *Pursuit* was written as a run-

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CIRCLE 113 ON READER SERVICE CARD

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time application in *DataFlex*, a relational database program, and is priced at $795 for the single-user DOS version ($1,895 for the Novell network version and $2,895 for the Xenix version).

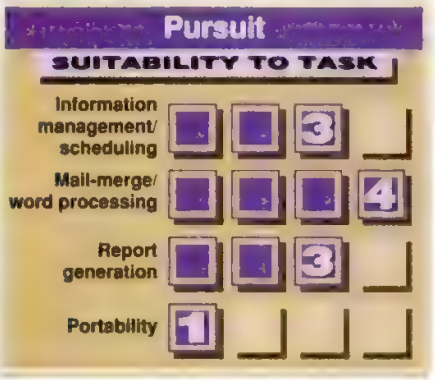
MARKETING FOCUS

To automate a marketing campaign in *Pursuit*, you first create one or more marketing paths. When you start a contact on a given path, *Pursuit* will automatically schedule form letters, brochure mailings, follow-up phone calls, and even faxes if you have the fax option. This not only saves you the chore of manual scheduling, it ensures that nothing will get overlooked.

Another notable strength is customization flexibility. As shipped, the program comes with about 40 fields, including those that a marketing operation will most likely use. If you need more, you can create a second data-entry screen with up to 15 fields and index any eight for sorts and searches. You can also create a personalized help system with answers to common questions from customers. *Pursuit* comes with more than 50 predefined reports, as well as a sophisticated query function that will let you define custom reports as needed. The number of reports you can save is limited only by disk space.

Other features include a calendar, autodialer, and full-featured word processor. The month-at-a-glance calendar is notable for its tight integration with the contact tracking function. You can view a detail list for any given day, change the date or time for any item on the list and the change will automatically appear in the contact record. Although there is no actual to-do list screen, the calendar detail list effectively provides you with one.

For sophisticated mail-merging, *Pursuit* will export data files in *Microsoft Word*, *WordPerfect*, *MultiMate*, or *WordStar* format. The package includes a word processing program called *DWP*, which is actually *NewWord*, a *WordStar* twin. As shipped, *Pursuit* will only import CSV or CR/LF format files, but Information Management Consultants say that import modules for any other format will be provided on request at no charge, even if the company has to write the module from scratch.

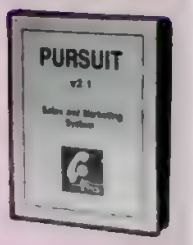


STRUCTURAL SHORTCOMINGS

As strong as *Pursuit* is on features, it is notably weak on ease of learning and ease of use. With the exception of a few pop-up boxes, the program has a look and feel that harkens back to the early days of PCs. The menu format presents numbered lists with an overwhelming 24 choices on a single screen and 11 choices on the main menu. You choose options by typing a number or by highlighting a choice with arrow keys and striking Enter.

The *Pursuit* contact screen is packed with more than 40 fields. Also shown is one of the few pop-up menus, displaying the options available from the contact screen. The two bottom lines list function key choices, including the note option for free-form notes.

FACT FILE



***Pursuit*, Version 2.2**
Information Management Consultants Inc., 7318 Harrison St., Omaha, NE 68128; (402) 592-4544.
List Price: $795; network version, $1,895; 286 Xenix version, $2,895; 386 Xenix version for four users, $2,895.
Requires: 640K RAM, hard disk, DOS 3.0 or later.
In Short: While *Pursuit* can serve as a standard contact manager, its real strength is its automatic scheduling function, which makes it an automated marketing package. Other strengths include flexible customization and a report generator. However, these are heavily counterbalanced by spotty on-line help and the lack of a logical, self-explanatory menu structure.

CIRCLE 408 ON READER SERVICE CARD

Another disadvantage of the menus is that they lack a logically consistent, self-explanatory structure. For example, three of the choices on the main menu are Account Follow-up, Maintain Accounts, and Account Maintenance, all of which could mean the same thing. Too often, you'll have to search through the menus to find the options you want.

Other shortcomings include a poorly organized manual and weak on-line help. Information Management Consultants states that since most people don't read manuals, "we provide perfect support rather than perfect manuals." And indeed, if you call the technical support line, the company will train you for free. However, support is only available from 8 A.M. to 5 P.M. Central Time, and you have to pay for the call.

Pursuit is a mixed bag, strong on functionality. However, if you want a basic contact management package you can learn with minimum fuss and bother, you'll certainly want to look elsewhere. If you can make use of the automatic scheduling function with its emphasis on automated marketing, the steep learning curve may be worth conquering.

Sales Ally

by Alfred Poor

When you head out to do battle in the business world, you could use a strong ally to help carry the load. *Sales Ally* from

Scherrer Resources may not be one of the best-known contact management programs, but it should be. At a list price of $395 for the single-user version, and with two different levels of multiuser versions available, this is a feature-rich package that should appeal both to sales and non-sales users.

The program is built on Novell's *Btrieve* development language and database management system. The result is a system that has a crisp, text-based look with plenty of sophistication. Most screens offer a string of function-key commands listed across the bottom line of the display. Some of these commands open windows, which either prompt for more inputs or offer lists of predefined choices. F1 brings up context-sensitive help at nearly every turn in the program.

Sales Ally relies primarily on a single data-entry screen that drives all other functions. There is room for three different phone numbers (which can be dialed automatically using a modem), title, nickname, company, division, and ten user-definable fields for additional items. When you set up a defined field, you also get to specify the type of contents it can accept, even to the point of defining a list of acceptable responses that can be popped-up during data entry.

One outstanding feature is the ability to relate records through links, either in horizontal or in branching relationships. This makes it easy to jump between colleagues at the same level within a company, or to move throughout the organizational structure of departments.

The program is rich in useful features. There are lots of ways to create letters, ranging from mail-merged letters and reports that can be applied to one or many records at a time, to quick letters that you can create on-the-fly right at the data-entry screen. The program has its own full-featured word processing module, including support for LaserJet fonts, and you can use the DOS shell feature to run your own favorite word processor. Since the program only takes up about 10K RAM, it leaves plenty of room to run other applications; you can load *Sales Ally* and let it run all day.

The word processor included with *Sales Ally* has some sophisticated features, including the various printer control options listed in the window to the right. The program has been configured for a LaserJet Series II with a Z-font cartridge.

There are dozens of preformatted reports and labels, but it's easy to create your own using the report formatter and word processor. You can keep notes on each record, and each note will be time and date stamped—though you can edit the time and date if you need to enter information at a later time. You can pop up a calculator, a calendar, or an expense-tracking program. There are also features that let you take orders over the phone.

One of the program's greatest strengths is its ability to support multiple users. Even in a single-user version this has benefits, since records can be tied to "owners" and access controlled through passwords. It is simple to export and import sections of the database, so you can take portions on the road with a portable computer and then upload the changes to keep the main database current. *Sales Ally* also imports comma-delimited ASCII files in a flexible and friendly way, making it a snap to bring in data from outside sources.

Other multiuser features include the ability to scan others' schedules to find times for meetings and other events.

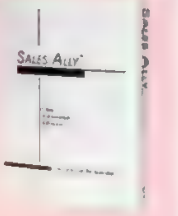
ROOM FOR IMPROVEMENT

The program is not without fault. The quick letter does not include the printer font support offered by the word processor. The word processor also requires you to define your printer during installation, even though you already provided the information for the main program. The program is too big to fit on floppy disks and requires a laptop with a hard disk, although you can access data files stored on floppy disks. The user interface is not always intuitive. For example, the Escape key sometimes removes the current screen, while at other times only F10 will work. And for some reason, the Insert key is used to erase the contents of a field on the data-entry screen.

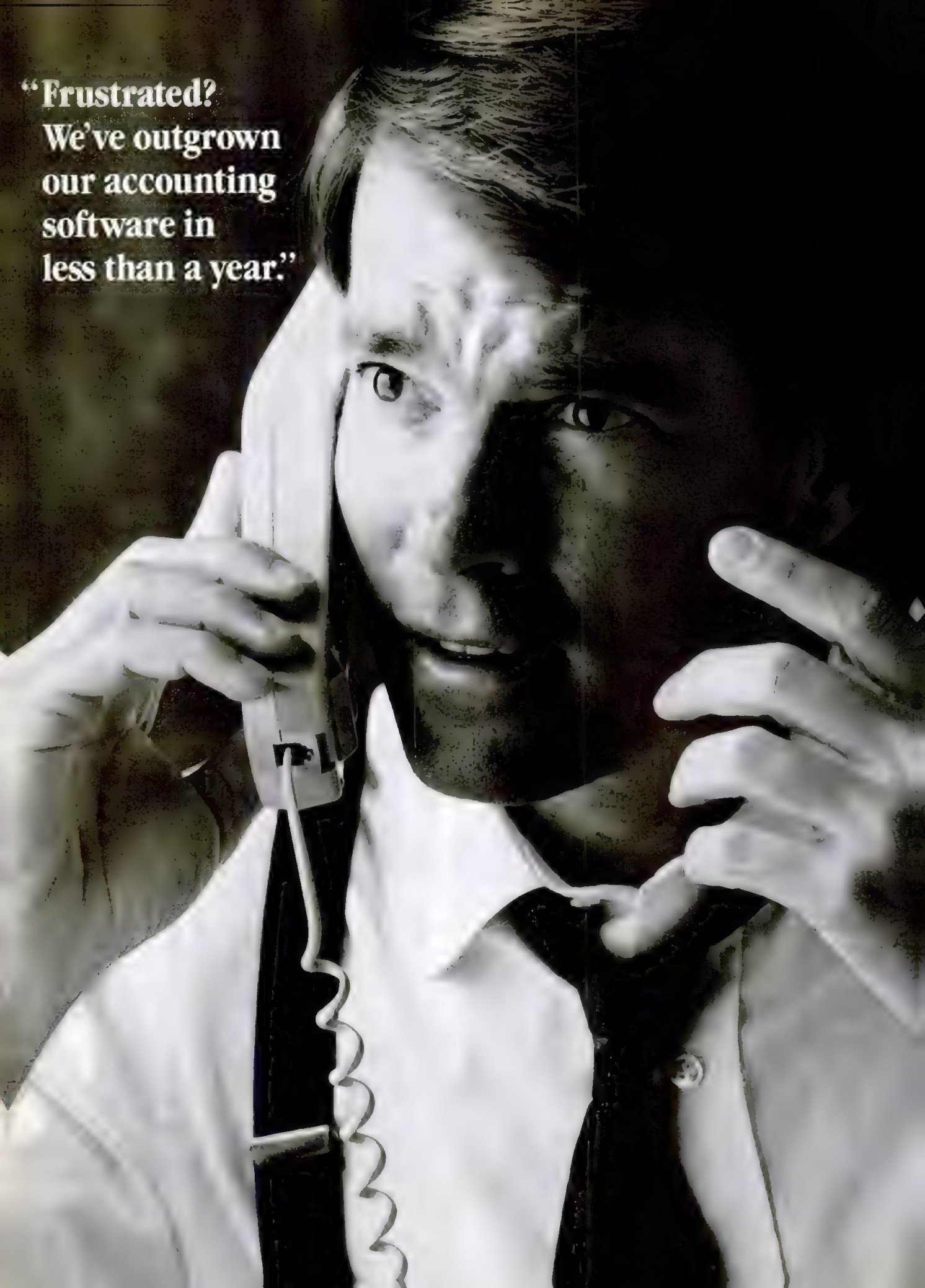
These turn out to be minor flaws, however. The program is fast, flexible, and efficient. It makes it easy to get a lot of work done in a hurry, and lets you save all your letters and reports to be printed in a batch at the end of your work session. It forces you to confront work that is overdue, and the macro facility makes it easy to reschedule tasks for a later time.

FACT FILE
EDITOR'S CHOICE

***Sales Ally*, Version 3.10**
Scherrer Resources Inc., 8100 Cherokee St., Philadelphia, PA 19118; (800) 950-0190, (215) 242-8751.
List Price: $395; TwinStation (two users with connecting hardware and software), $850; network version, $1,495.
Requires: 384K RAM, DOS 2.0 or later for single user, 3.1 or higher for network or TwinStation. Hard disk recommended.
In Short: *Sales Ally* is full-featured and powerful but gives you the flexibility to work the way you want. It gets out of your way when you want to run other programs and makes it easy to coordinate with others on your team.



CIRCLE 409 ON READER SERVICE CARD


"Frustrated?
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"Our accountant walks in this morning. Says we've outgrown our accounting software. Tells me we need more in-depth sales analysis, better inventory control, and we need to begin networking our PCs. How does your company afford to keep upgrading its accounting software?"

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"Then invest in Macola. It's versatile, customizable, and no other software can touch Macola's LAN performance. I'd go into more detail, but it's almost seven o'clock."

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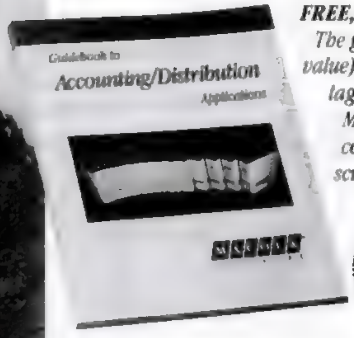

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If you need a strong assistant in your corner, consider *Sales Ally*. Whether you work by yourself or as part of a large team, this program can help you track the tasks and get the work done.

SalesPro

by Tom Unger

Looking for an inexpensive entrance into the world of contact management? The SoftPro Group's $195 contact management package, *SalesPro*, provides the ease of use that equates fast learning and the basic functionality that will satisfy the needs of many desk- and road-bound salespeople.

SalesPro ships on two floppy disks, and although no automated installation program is included, the manual gives instructions concerning the files you'll need to copy to make the program run. All the necessary files will fit onto one 720K floppy disk for effective portability.

The core of *SalesPro* is its client database and its client data-entry screen. The fields included in the standard database are those you're used to seeing: client ID, name, phone number, company, address, voice and fax phone numbers, and last date called. Should you wish to change any or all of the fields, the database and screen are fully customizable. Once you have entered a client/contact, you can perform a variety of tasks on that record, including making and logging calls, adding a follow-up call to a to-do list, and setting an alarm to remind you when you need to make that follow-up call. You can attach an unlimited number of to-do notes to each client's record.

DATA SEARCHING

SalesPro provides a number of data-search methods—including the ability to search across a number of databases for like information—and you can save up to 20 different kinds of search queries by using the software's macro generating facility. The program will also automatically search for duplicate client entries in the same database based on the client ID number and alert you of any duplication errors.

The client database, and any others you decide to customize, are stored in a standard, comma-delimited database format, making export to other programs such as spreadsheets and databases simple and direct.

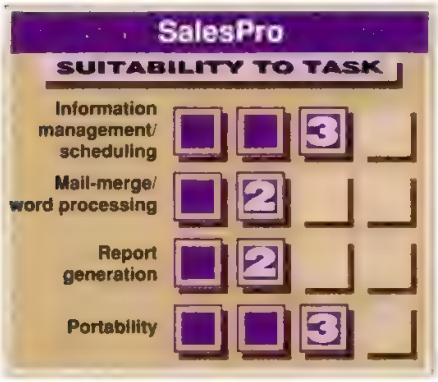
SalesPro includes its own simple word processor, full mail-merge and label-making facilities, as well as a monthly calendar, calculator, inventory and expense tracker, user-definable databases, system and file protection, and a backup/restore feature. It also boasts a host of personal features, such as a stock manager, yield record, purchase record, and an IRS tax worksheet.

Where the program shines less brightly may present drawbacks for some users, depending on the level of complexity you desire in a contact manager. Although the program does have a phone dialer, it cannot handle lengthy dialing prefixes or separate local numbers from long distance—an especially important feature when you spend equal amounts of time in the office and on the field—and it does not offer the option to time and date stamp calls.

The to-do list, word processor, and calendar suffer from lack of depth as well. For example, you can add follow-up calls directly to your to-do list from the client database and set the event alarm to buzz when it's time to make the call (known in *SalesPro* as a "hot note"), but you cannot attach notes to items in the to-do list brought in from the client database. You can attach notes if you add the appointment manually. And *SalesPro* cannot automatically carry undone tasks over to other days.

SalesPro does offer strong, yet somewhat rudimentary report-generation facilities. The version we tested did not come with a complete manual (a SoftPro Group representative claims that the manual has been extensively revised and will be shipping with the product by the time you read this review).

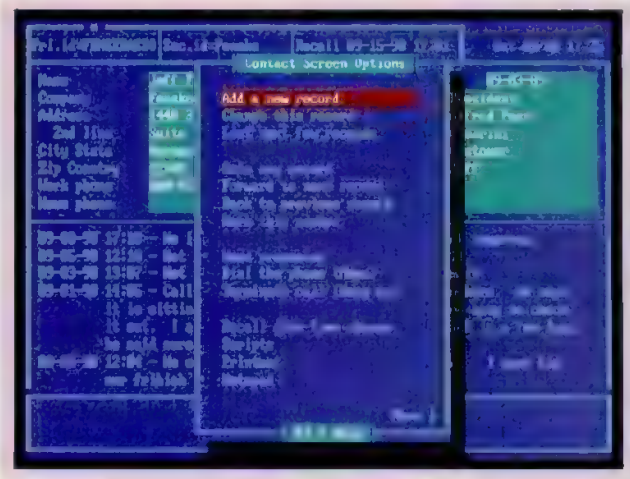
SalesPro excels at straightforward contact recording and management. It does not have the same level of versatility as *Act!* and some of the others included in this roundup. But if simplicity is essential, you should give *SalesPro* a try. For its price, it may be hard to beat.



FACT FILE

***SalesPro*, Version 1.0**
The SoftPro Group, 12922 Hasbrook Dr., St. Louis, MO 63146; (314) 576-7656.
List Price: $195.
Requires: 256K RAM, DOS 2.0 or later. Hard disk recommened.
In Short: A hard-to-beat-for-the-money package with a variety of sales-speeding features, although some of the features such as reporting, word processing, and the to-do list lack the depth and sophistication of contact managers such as *Act!*.

CIRCLE **410** ON READER SERVICE CARD



***SalesPro*'s Client Database is fully customizable; easy-to-use pop-up menus, like the one shown here, render most routine contact actions simple and straightforward.**

TeleMagic

by M. David Stone

Remote Control International sells *TeleMagic* as a telemarketing program, but it would be a mistake to pigeonhole this $495 package ($1,995 for the network version). While it offers sophisticated telemarketing features, such as the ability to create an invoice while working with a contact record, it still rates as a high-powered contact tracker without them.

TeleMagic takes its orders from a combination of pop-up menus, function-key commands, and single-letter commands. This could easily be confusing in a poorly designed program, but *TeleMagic* is nothing if not well designed.

SURPRISING DEPTH

In fact, the *TeleMagic* menus are deceptively simple. The main menu has eight choices: Go to any record, Add a record, Dial the phone, Word Processor, Reports, Printout, Filters for selecting records, and Other Options. Choose Other Options, and you'll find another short menu of six choices, including Master Controls for setup, Database utilities, and Function keys for customizing up to 30 macros.

Most packages with short menus have few features or quickly become tiresome as you trudge through nested menus. *TeleMagic* has plenty of features, yet avoids the usual pitfall of nesting. Part of the credit goes to careful thought in choosing what gets nested where. Even more important is the ability to access many commands from more than one place in the program.

For example, the main menu and the contact-entry screen have choices for phone dialing and word processing. And several of the function key options—including the calculator, calendar, help screen, and shell to DOS command—are available at anytime. The result is a program that's easy to use for beginners and advanced users. And as you use it, you'll find that it gradually reveals a surprising depth of features.

THE FLEXIBILITY EDGE

Customization is another strong point. As shipped, *TeleMagic* has about 20 fields, plus a free-form note field with time and date stamping for each note. The fields include all the information you're likely to need for each contact, but you can define up to 78 more fields. You can also modify the standard fields.

Other customizable features include help screens and scripts—text files that a telemarketer might read as a sales pitch or that might include any kind of reference information you may want to use while on the phone. *TeleMagic* will also let you substitute your favorite word processor for the built-in editor, define up to 50,000 filters for selecting records, and choose whether to use password security or not.

Still other features will let you index records by your choice of fields, and import or export sets of records using fixed-length or *dBASE III* format. Predefined reports include choices for form letters, labels, envelopes, Rolodex cards, a list of scheduled calls, and a Telephone Usage Analysis that yields a phone log as part of the report.

One last notable feature is *TeleMagic*'s ability to run with other applications. A telemarketer might work with *TeleMagic* all day long, but for others the program includes a built-in version of *AutoSwap*. This frees up all but 10K of RAM when you shell out to DOS, leaving plenty of room to load another program. Even better, *TeleMagic* will run in the background under *Microsoft Windows* 3.0.

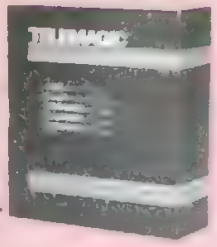
TeleMagic's few shortcomings are relatively minor. For example, it would be useful to change filters or define new ones while at the contact record, rather than return to the main menu. The one important oversight is that you can't create multiple contact records as part of a single company record. However, you can work around this by creating a different record for each contact and sorting by company name.

Clearly, *TeleMagic* is not just for telemarketing. The combination of easy learning, customization, and the sheer number of features puts it in the running for nearly any contact tracking application from light-weight to heavy-duty. Rank it as the program of choice for telemarketing, and

The *TeleMagic* data-entry screen is divided into two sections, with basic information on the top half, and free-form text notes on the bottom. Note the automatic time and date stamps on the text notes. The pop-up menu is divided into several easily readable sections, with most choices being self-explanatory.

FACT FILE

***TeleMagic*, Release 11**
Remote Control International, 5928 Pascal Ct., #150, Carlsbad, CA 92008; (800) 992-9952, (619) 431-4000
List Price: $495; network versions, $1,995.
Requires: 640K RAM, hard disk, DOS 3.1 or later.



In Short: Although designed and sold as a telemarketing program, *TeleMagic* is also a high-powered contact manager. Features include an easy-to-learn menu structure, data-entry screens allowing up to 100 fields, free-form notes, a shell to DOS command, a calendar, a calculator, and a sophisticated report generator.

CIRCLE 411 ON READER SERVICE CARD

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one of the best for most other contact management applications.

TeleSell

by Tom Unger

Contact management is just one part of TeleVell's $695 package, *TeleSell*. This three-part package, which its manufacturer bills as a LAN-to-laptop sales solution, comes complete with three modules—the first of which is written for the salesperson who documents all direct contacts.

The second module, one level up the administrative ladder, is designed for the managers of sales, advertising, and forecasting groups. The data from each salesperson can be accessed on a LAN and used to establish corporate sales, revenues, and advertising figures based on the data gleaned from individual salespersons' databases. The third module is designed for the system administrator who has access to the records of the previous two groups, and can set system defaults, produce system-wide reports, pull in data from remote sales forces, and generate system-wide information to be placed on bulletin boards accessible by individuals and subgroups. *TeleSell* will operate in a variety of networking situations, including Novell and IBM networks.

This much complexity and structure in one system naturally precludes a number of features one might expect to find in single-user systems. *TeleSell* does not include many of the features you'll find in other packages in this roundup. A built-in word processor and calendar are absent. However, *TeleSell* does have a user-definable, program-list function that allows you to choose up to four programs to shell out to in order to perform such tasks as word processing, spreadsheet creation, and analysis. Mark LeVell of TeleVell says that the company has worked directly with the makers of *WordStar*, *WordPerfect*, *Lotus 1-2-3*, and others to ensure that *TeleSell* is fully compatible with their programs. When you do shell out to an outside application, *TeleSell* shrinks to a mere 7K of RAM.

Beyond that, *TeleSell* is as strong in the actual area of contact management as any of the other review packages. The heart of the system is the salesperson's module and its associated menu from which you can choose to update or create contacts, make calls, display and/or update a to-do list, show a bulletin board that is accessible to all members of a group, print letters composed in another program, or create reports.

You can list an unlimited number of contacts per company, and multiple individuals or products for each company in the database. This provides extraordinary flexibility for companies with many products and contacts who must be served by a single salesperson. *TeleSell*'s client-database screen is composed of 24 user-customizable fields, as well as a scrolling area that will list an unlimited number of contact actions.

Unlike programs such as *SalesPro*, *TeleSell* will automatically determine if a number is local or long distance, and will add area codes to numbers that are usually local if they are dialed from the field. Users can text-search appointments in the to-do list, and *TeleSell*'s unique "Everywhere" feature will search for strings in the user's database as well as in every other database on the system to which you have security access.

TeleSell will handle all standard mail-merge tasks, including importation of boilerplate text and envelope or label printing. The program will also work with other fax-capable programs such as *ComWave* and *GammaLink* to give you fax capabilities as well.

TeleSell includes an excellent context-sensitive on-line help facility and a video tutorial that makes installation and startup relatively painless.

Although it lacks many of the functions that round out the feature-lists of other contact management packages, *TeleSell* is a system that dedicates itself to the task at hand and succeeds admirably at strict contact and sales information management. For a company, large or small, it would be difficult to find a more efficient way to gather and manage vital sales information. ■

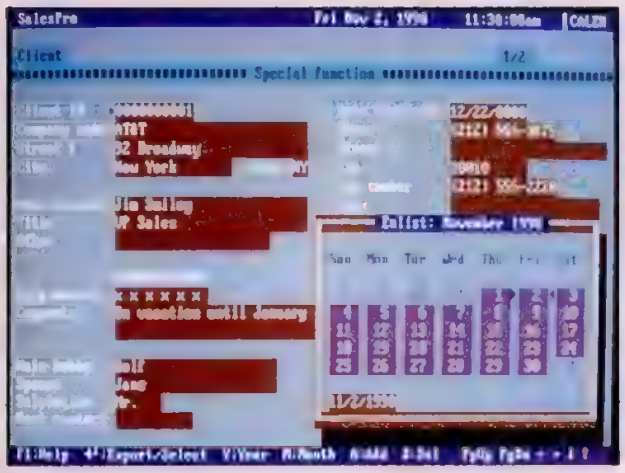
FACT FILE

***TeleSell*, Version 2.0h**
TeleVell Inc., 3175 De La Cruz, Santa Clara, CA 95054; (408) 748-0111.
List Price: $695; four-user version, $1,995.
Requires: 640K RAM, hard disk, DOS 3.0 or later.
In Short: This three-module system is designed to track information at all levels of the company, from the CEO's office to the salesperson's car. Although it lacks the PIM-like features of other contact managers, it excels at what it does, providing extremely versatile customer and client data management and a nearly unlimited relational database structure.

CIRCLE 412 ON READER SERVICE CARD

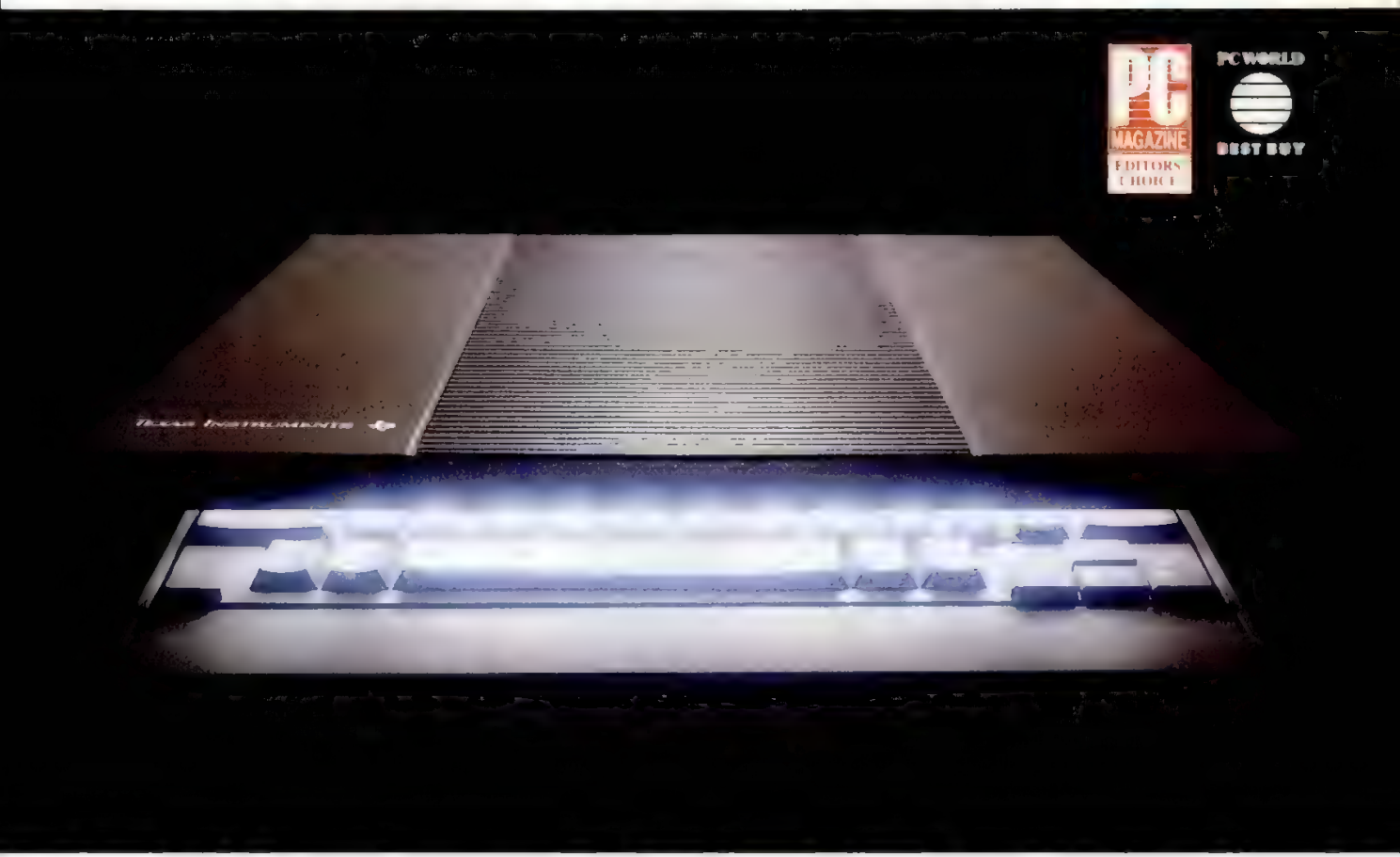
TeleSell SUITABILITY TO TASK

Information management/ scheduling	■	2		
Mail-merge/ word processing	■	■	3	
Report generation	■	■	3	
Portability	■	■	3	



The *TeleSell* Contact module allows a virtually unlimited number of contact actions and accompanying notes for each contact.

The new look of power.



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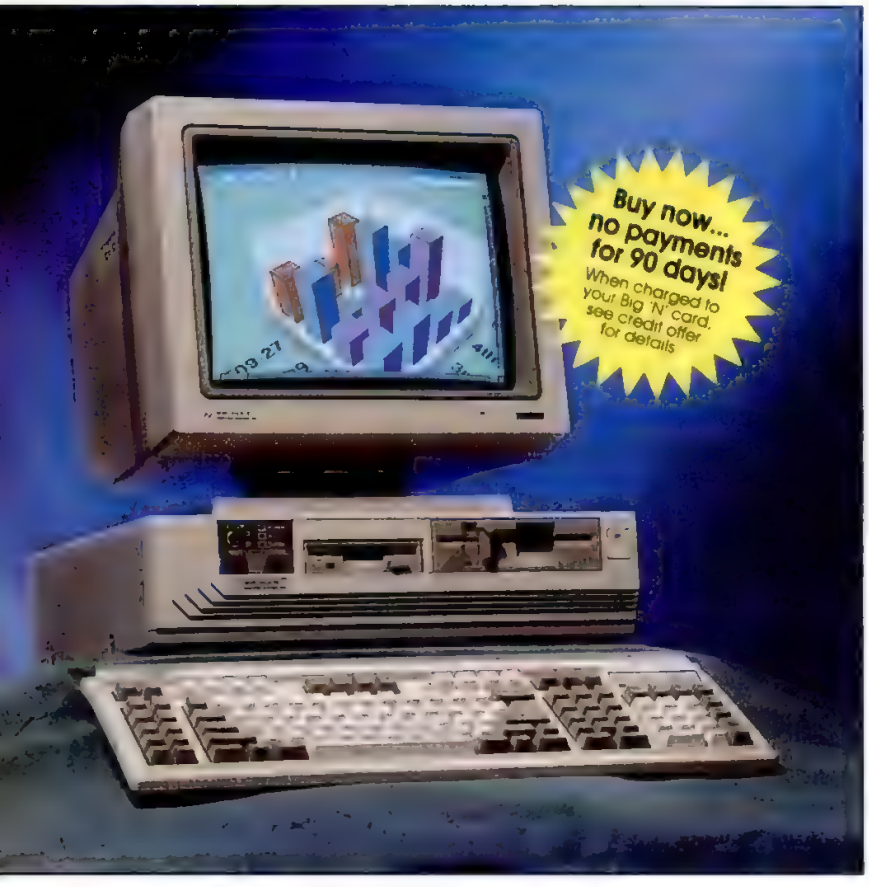

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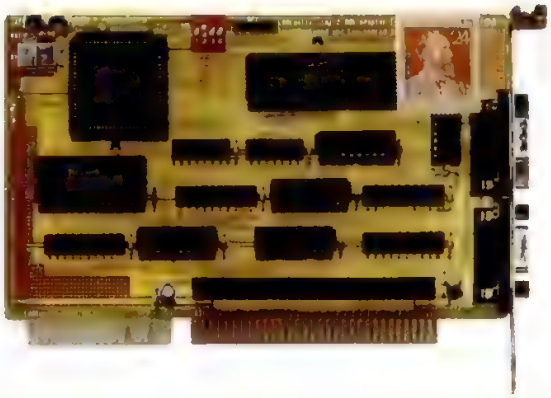

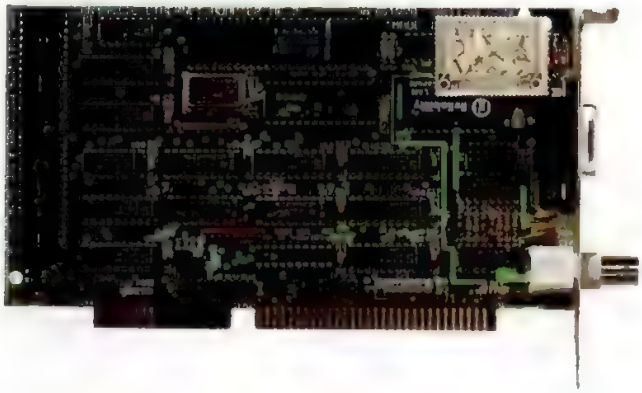

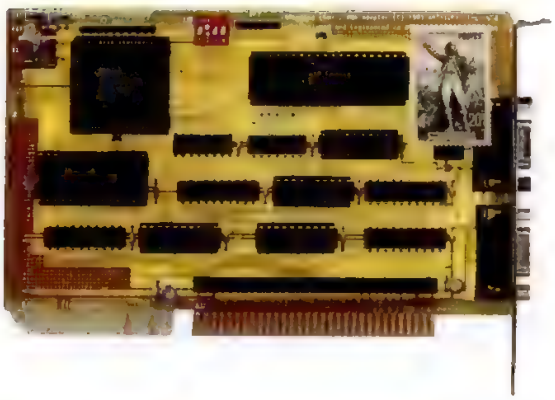

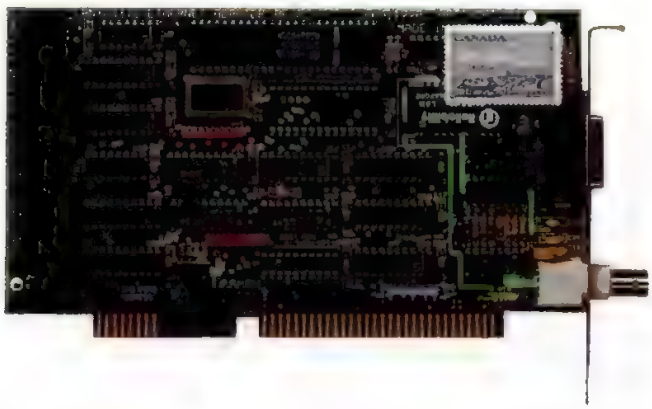

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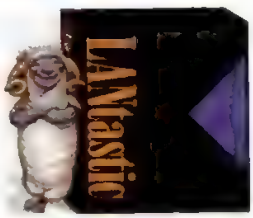

ARTISOFT

CIRCLE 254 ON READER SERVICE CARD

*Based on manufacturer's suggested retail price for a 10-computer LAN using LANtastic 2Mbps adapters. Cost is slightly higher for smaller networks. ©1990 ARTISOFT. LANtastic is a trademark of Artisoft.

ENDURANCE TESTS

Portable Computing

by Jennifer Zaino

There's more to portable computing than a portable PC and a modem. Not that the actual computers aren't a big part of the equation—in fact, the six portable PCs represented here form the heart of this endurance test. But they are joined by a range of other devices that truly make the movable electronic office a reality, whether you have to transport your information from coast to coast, or just room to room.

In this endurance test, the 386- and 386SX-based portable systems are put through their paces alongside such products as LCD panels for taking your presentations on the road, removable mass storage devices that make your data truly transportable, and a pocket LAN adapter for plugging into your company's network while you're at the Toledo Hilton. One of our reviewers also spent some months with one of the most popular portable printers, the Kodak Diconix Model 150 Plus, because no office—even when it's in a hotel room—is ever really paperless.

Portable computing isn't limited to the luggable you'll take with you on your next trip; a range of peripherals like LCD panels and mass storage devices also help to make the movable, electronic office a reality.

OUR CONTRIBUTORS

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While three of the computers we review here provide battery power, most are AC-only units—hence their more proper designation as "transportables." Interestingly enough, the weight of the systems involved—generally in the neighborhood of 20 pounds—made a few of our reviewers reluctant to bring them along on trips that involved airplane hopping or subway shuttling, although they agree that business travelers who constantly need this kind of portable power can probably handle the trade-off in weight.

For our reviewers, the value of the machines' portability was sometimes most apparent when they needed a machine that could move easily from room to room, or from the office to home (provided they could get there by cab!). What some reviewers also realized was that with systems this powerful, it often made sense to keep them in the *office* as their *primary* machines. Even the gas plasma screens predominant on most of these machines, as well as the less-common LCD screens, proved comfortable for long-term viewing and our authors stuck with them even when external monitor options were available.

The past few months' explosion in the world of LCD panel technology only confirms that the only thing you can be sure of is that you can't be sure of anything. For instance, in the six months we've been looking at these products, one company's unit has been upgraded *twice*. While Infocus continues to sell the original eight-color 480C PC Viewer that earned an honorable mention back in February 27, 1990, its progressive moves to first a 64-color LCD and then a 5,000-color model proved to be the real story here, with the latter device being the most capable of real-world presentations. Nview Corp., which won the Editor's Choice for the black-and-white Viewframe II+2 (tested here), has itself recently introduced a 16-color LCD panel.

Most of the products that form the basis of our portable computing endurance test—removable mass storage devices, a portable printer, and an external network adapter card—went a long way (both literally and figuratively) toward proving that in the computing world, life is truly a movable feast.

PORTABLE PCs

DELL COMPUTER CORP.

Dell 316LT

by Donald P. Willmott

Weighing in at a chunky 16.5 pounds in its traveling configuration (two batteries, no AC adapter), the Editor's Choice-winning Dell 316LT is not the kind of portable computer you want to have on your shoulder when you're running late for a plane. But, more to the point, why have it with you at all? A machine this good deserves a permanent place on your desk.

The 16-MHz 386SX-based 316LT, priced at $3,399 with 2MB RAM and a 40MB hard disk, is $700 less expensive than it was at the time of our March 13, 1990 review. Given that the price includes one year of on-site service through Xerox, the 316LT starts out with a leg up on the competition.

Personally, I didn't have the need to evaluate the on-site service part of the equation. After six months of use, the machine and all its parts are doing fine, though some pieces are less pleasing than others. I haven't grown used to the stiffness of the 83-key keyboard, for example, but its layout is excellent and includes 12 full-size function keys across the top.

Some people who have looked at other 316LTs, as well as some who have looked at mine, have called the review unit's detachable backlit VGA screen muddy. I disagree. My machine's display did have some dark patches of horizontal banding, but the problem wasn't at all serious. I enjoyed testing the screen with *PC-USA* and *PC-Globe*, two vibrant packages full of maps that use hatching patterns on monochrome screens to substitute for color. The 316LT did an admirable job displaying these maps. My biggest complaint with the screen applies to all LCD portable systems: You have to face the display full-front or you won't see a thing. Traveling salespeople with whiz-bang presentations should keep this in mind because the number of people who can watch your presentation is limited.

The 40MB hard disk was interesting mostly for being uninteresting: It's been fast, quiet, and trouble-free. More intriguing were the 316LT's power handling strategies. When the one-and-a-half pound battery was about to die (generally after about 90 minutes with minimal disk access), I was warned and given the chance to pop the battery out and stick in a new one without shutting off the machine. An oversize AC power brick also accompanies the unit.

I have no compatibility complaints with the 316LT. To test it, I transferred a good portion of my desktop hard disk over and used the 316LT just like my everyday system. Nothing went wrong.

My limited experience with Dell's technical support staff (anonymous experimental phone calls placed at various times of day to ask questions of varying technical difficulty) has been very satisfactory—as good as Dell desktop PC owners reported it was in our recent service and reliability

Dell 316LT

Last Reviewed: March 13, 1990, page 129.
Reason Selected: Editor's Choice.
Positive Findings: Well lit black-on-white display; good hard disk performance; rugged construction.
Negative Findings: The strangely placed handle can lead to leg scratches.

UTILITY
COMPATIBILITY
PERFORMANCE

survey (September 25, 1990). The only aspect of tech support to criticize was the length of time it sometimes took to get my calls answered, though a 5-minute wait isn't too bad compared with some other tech support lines I've called.

Just how portable was the 316LT? Not portable enough, though no system over seven pounds really is. The machine was hampered not only by weight, but also because it hangs slightly diagonally when you carry it by its handle, which is mounted off-center. Hold it one way, and the top angles in and scratches your thigh. Hold it the other way, and the bottom angles in and scratches your calf. Though contributing editor Bill O'Brien called the machine "tidy" and referred to its "low-weight factor" in his evaluation, he was expressing admiration for the fact that 386 processing power and a sizable hard disk could be portable at all. As a potential piece of luggage, which is the way I look at portable PCs, the 316LT is too heavy.

Curmudgeonly pontifications aside, I appreciate the engineering that has gone into the Dell 316LT. No need to reconsider this Editor's Choice winner.

Dell 316LT

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; (800) 426-5150, (512) 338-4400.

List Price: With 2MB RAM, 40MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA LCD screen, one parallel port, one serial port, and DOS 3.3, $3,399.

CIRCLE 413 ON READER SERVICE CARD

DOLCH COMPUTER SYSTEMS

Dolch V-PAC 386-25C

by Robin Raskin

In a lunchbox-style case—of a size appropriate for a very large and hungry steelworker—the 19-pound Dolch V-PAC 386-25C packs a 25-MHz CPU, 2MB of RAM, 32K of 25-nanosecond cache RAM, an 80387 math coprocessor, a 40MB hard disk, a 3.5-inch floppy drive, a keyboard, a Paradise VGA Plus graphics board, a 200-watt power supply, and a crisply legible 11-inch gas plasma screen. The memory is expandable to 8MB on the motherboard and an additional 8MB via a 32-bit add-on card; disk options range in sizes up to 200MB; four full-size ISA 16-bit slots are available; and there is even room for a second floppy disk drive.

Long-term exposure to this machine

ENDURANCE TESTS

PORTABLE COMPUTI

has changed the way I use computers. With the $8,490 Dolch, I can have desktop power anyplace I want it. There is an optional battery pack, but the Dolch is power hungry (not to mention heavy). While it's usable on a plane, train, or bus, it's not really practical. But I've been able to use it at home in the living room while supervising the kids' homework and for software

Dolch V-PAC 386-25C

Last Reviewed: March 13, 1990, page 136.
Reason Selected: Editor's Choice.
Positive Findings: Very expandable; great display.
Negative Findings: Keyboard cable is too stiff; reset switch can be accidentally activated too easily.

ENABILITY

COMPATIBILITY

PERFORMANCE

development projects over weekends in the country. Ditto for a working vacation in Florida, where I finished the documentation for a software project.

The advantage of the Dolch V-PAC 386-25C over other portables was its power. While a colleague struggled to cram a stripped-down version of *Microsoft Word* onto his Toshiba 1000SE, I was using *Windows* 3.0, *Drafix Windows CAD*, Zortech's *C++* software development system, *Microsoft C*, various software development utilities, the *Norton Utilities*, *PC Tools Deluxe*, the *MKS* toolkit, and Lotus's hefty *Manuscript* word processor on my Dolch. And of course, Rupp's *FastLynx* file transfer software was invaluable in helping me to easily exchange files with my more stationary machines.

The Dolch proved a flawless and fleet performer, but it wasn't perfect. My early fear was that the screen would be an obstacle, but over months of use I never found its orange-on-black display tiring or difficult. The biggest screen problem was heat; it gets almost too hot to touch when you use software like *Windows* that illuminates most of the pixels. However, the screen's 16 distinguishable shades of gray do a creditable job with *Windows*, and the lack of ghosting makes mousing around much easier than on LCD portables.

My early affection went to the keyboard, which has a good feel and standard three-quarter-inch key spacing. However, over time these feelings waned. The Dolch keyboard cable was too short and too stiff; all it was good for was placing the keyboard on the table in front of the machine. I ended up using the machine with a generic keyboard that featured a longer and more flexible cable, and a marginally more familiar layout. However, it is to Dolch's credit that its machine is respectful enough of PC standards to accommodate aftermarket devices such as keyboards.

Another complaint is the housing. The plastic case was rugged—the keyboard survived several unscheduled trips to the floor—but not very elegant. The door to the expansion card connectors seemed flimsy, and the front-panel reset button has a hair trigger. That's not just a theoretical complaint—once some papers jostling against the reset switch did accidentally reboot the machine. A more trustworthy case would be a better match for the speedy and reliable electronics.

Dolch earned the *PC Magazine* Editor's Choice in the March 13, 1990 review of 386-based portables partly because it was the fastest machine in the group. In our December 12, 1989 review, it also won Editor's Choice because of its speed and power. Both of those reviews concluded with the still-appropriate summation: For those who want desktop speed and power with the compactness of a portable, the Dolch PAC 386-35C can't be beat.

Dolch V-PAC 386-25C

Dolch Computer Systems, 372 Turquoise St., Milpitas, CA 95035; (800) 538-7506, (408) 435-1881.

List Price: With 2MB of RAM, 40MB hard disk, 3.5-inch floppy drive, VGA gas plasma display, 80387 math coprocessor, 200-watt power supply, $8,490.

CIRCLE 414 ON READER SERVICE CARD

IBM CORP.

IBM PS/2 Model P70 386

by Edward L. Perratore

What can you say about a machine that defies endurance testing with the same aplomb that earned it an Editor's Choice? Aside from the fact that the 21-pound IBM

PS/2 Model P70 386 performed its own endurance test on my back, the system proved itself a long-term winner.

Our review model was crammed with options. In addition to 8MB of RAM and a 120MB hard disk, this $14,129 machine also included a 387-20 floating-point coprocessor, a 2,400-bit-per-second internal modem, and a 3270 emulator card. A lesser configuration comprising 4MB RAM and a 60MB hard disk sells for $7,695. All configurations come with a VGA gas plasma display, a 1.44MB 3.5-inch floppy drive, one parallel port and one serial port,

IBM PS/2 Model P70 386

Last Reviewed: March 13, 1990, page 149.
Reason Selected: Editor's Choice.
Positive findings: Flawless processor, memory, and hard disk performance; outstanding display.
Negative findings: Stiff keyboard cord; rear case cover is lightly constructed.

RELIABILITY
COMPATIBILITY
PERFORMANCE

a mouse port, and a device connector you can use to hook up an external 5.25-inch floppy disk drive.

Once I got past grumbling about IBM's usual high-end price, I was left with little to complain about. I decided against leaving DOS 4.0 on the machine and kept the entire 120MB hard disk partitioned as C: under DOS 4.01. I loaded program after program onto the drive, eventually transferring the entire contents of my own desktop PC's 65MB hard disk (both partitions) using White Crane Systems' *Brooklyn Bridge*. Fast file access, not a hint of a bad sector from a *Norton Utilities* analysis, and no stray clusters whatsoever marked my six months with the P70.

Ordinarily, I find gas plasma displays irritating after too much use. Over the testing period, however, I found myself staring into the thing for many a late night. If it didn't bring on throbbing headaches at 2 A.M., it never will. Part of the reason is the display's deft handling of the VGA color spectrum as shades of orange/gray. A few program screens initially appeared hard to read, but typing "mode co80" before running these programs, as IBM recommends, invariably did the trick.

No memory problems plagued my work. In fact, the P70 took on every TSR I threw in—even *Lotus Express*. The internal modem did its job without a hitch, too, as did the mouse and other I/O ports. Untested was the 3270 emulator (a friend with a 370 mainframe was away).

If you need to get at the motherboard, entry is a snap thanks to three screws that can be turned with a coin. The P70's nonslip handle must have been tested in New York City during the summer. And, aside from the P70's overall weight, the model's design and balance allow easy transport. The light construction of its rear case cover troubled me, though. You'll need to be careful with those little sliding doors that permit access to the ports and power jack.

One other quibble is that the keyboard's cord proved entirely too stiff. And the keyboard, I am convinced, will be too clicky for many users (but for a portable PC, that's a compliment). You won't be able to tell where IBM paired down the length of its keyboard—no mental adjustments from your usual desktop PC will be necessary.

IBM is no stranger to the occasional uninspired product release. With the IBM PS/2 Model P70 386, however, Big Blue flexes the muscles that made it number one, and presents a portable PC that's a class act all the way.

IBM PS/2 Model P70 386
IBM Corp., contact your nearest authorized IBM dealer; (800) 426-2468.
List Price: With 8MB of RAM, 120MB hard disk, one 1.44MB 3.5-inch floppy disk drive, VGA gas plasma display, 387-20 coprocessor, DOS 4.0, mouse port, one parallel port, one serial port, and external device connector, 2,400-bps internal modem, and 3270 emulator card, $14,129.
CIRCLE 415 ON READER SERVICE CARD

PC BRAND INC.

PC Brand 386/25 Cache Portable III

by Diane D'Angelo

During six months of steady use, the AC-only PC Brand 386/25 Cache Portable III delivered nearly brand-name performance for below brand-name price. In this case, "nearly" meant a lot more than just good enough. The system was helped by a 32K RAM cache, which was lacking in the unit we originally reviewed in our March 13, 1990, issue.

The PC Brand Portable III is one of those Compaq Portable III look-alikes. It measures 9.8 by 16.2 by 8.3 inches (HWD) and weighs about 25 pounds. Maneuvering this heavyweight into its canvas carrying case is like shoving an anvil into a sock: It's a very tight fit. Anyway, my experience with it leads me to recommend that you don't sling this monster over your shoulder, except to the elevator or the car.

PC Brand 386/25 Cache Portable III

Last Reviewed: March 13, 1990, page 179.
Reason Selected: Honorable mention.
Positive Findings: Welcome inclusion of both 5.25- and 3.5-inch floppy disk drives.
Negative Findings: Display needs better contrast; the reset button is poorly placed.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Use a luggage carrier.

Once I got the Portable III up and running, I found that it was worth the weight. The fully loaded $4,784 review unit was a wish list come true: 4MB RAM, a 100MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch disk drives, a VGA gas plasma display, one parallel port and one serial port, DOS 4.01, utilities, and carrying case. Add a 1,200-bit-per-second internal PC Brand modem (for $49), and you've got all the on-the-road computer you'll need.

I used the open 8-bit slot for a Microsoft Mouse bus card, which clicked right in very nicely. Lots of time was spent using *Microsoft Windows/386* and Aldus *PageMaker* on the machine—both ran like a charm. Text was crisp, but I initially had a problem with contrast in the highlighted menu bars. Having ported *Windows* over from my VGA color monitor-equipped desktop machine, I had to reset it to run in black-and-white mode to enhance contrast. Contrast was also a problem in some non-*Windows*-based programs. *SideKick*'s calculator, for example, practically lost its Total. However, if you're familiar with a program, being unable to read a few options here and there is no big deal. *XyWrite III* and *Lotus 1-2-3*—which I use most of

the time—ran quickly, clearly, and without a hitch.

A more serious problem was that while adjusting the angle of the display, I lost all the edits in a *XyWrite* file when the reset button, located at the bottom-left corner of the bezel, was accidentally hit. This was no fluke. After a co-worker reading over my shoulder did the same thing, I had to put a "DO NOT TOUCH" sticker next to the button.

The detachable 86-key keyboard, which protects the screen in transit, isn't full size but felt just right. If you're like me and in the habit of resting your fingers heavily on the home keys between thoughts, you won't get a row of gibberish on-screen. I did seem to hit the Backslash instead of the Backspace key a lot more than usual, though.

I was impressed with the Portable III's overall sturdiness. It took its share of minor slams without a hint of trouble, which brings me to the service issue. Although nothing went awry with the unit while I had it, I periodically made anonymous calls to PC Brand's tech support line. On an average, I was put on hold for about 10 minutes, somewhat longer than I would have preferred, but at least all my questions were patiently and thoroughly answered. When I complained about the documentation because it was primarily devoted to PC Brand's desktop machines,

The sturdy PC Brand 386/25 Cache Portable III took its share of minor slams without a hint of trouble.

the support staffer offered to send me a manual for the portable; that was some weeks ago, and as of this writing I still haven't received it.

My biggest disappointment was the Portable III's FCC Class A rating, which made using it at home impracticable—a real drawback for a machine that you would conceivably want to use for take-home assignments. In the end, it's true that the PC Brand 386/25 Cache Portable III lacks the "fit and finish" of those dark and handsome brand-name portables, but then, you don't *need* a Mercedes to drive to the office.

PC Brand 386/25 Cache Portable III. PC Brand Inc., 954 W. Washington St., Chicago, IL 60607; (312) 226-3500.
List price: With 4MB RAM, 32K RAM cache, a 100MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch disk drives, a VGA gas plasma display, one parallel port and one serial port, DOS 4.01, utilities, and carrying case, $4,784.

CIRCLE 416 ON READER SERVICE CARD

TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T5200/100

by Jennifer Zaino

The $8,897 Toshiba T5200/100, with its 20-MHz 386 processor, 100MB hard disk, and 2MB of RAM, is one powerful portable. Extended use of the system showed it quite capable of performing the same tasks I'd ask of my desktop machine. Applications like Samna's *Ami Professional* ran fine under *Windows* 3.0; it's all less colorful on Toshiba's orange-tinted, gas plasma VGA screen than it is on my desktop monitor, but quite as functional. Nor were there any problems with character-based applications like *XyWrite*, *Lotus 1-2-3*, and *Harvard Graphics*. I also played a few rounds of *Railroad Tycoon*—not the most graphics-intensive game around, but still a good test for the display, which showcased it with satisfactory results.

At nearly 19 pounds, the Toshiba T5200 proved to be too much of a monster to lug through airports, so it didn't accompany me on out-of-town business trips very often. Instead, it wound up spending most of its weekday time sharing office space with my desktop machine. Not that I didn't put the T5200's reputation for ruggedness to the test. It has survived intact a number of car trips from *PC Magazine*'s offices in Manhattan to my home in Queens. We're talking rides along the Long Island Expressway and the 59th Street Bridge, both perhaps best known for their plethora of potholes.

I upgraded the Toshiba with an internal modem shortly after it arrived, a trouble-free process. Before the machine ever got a chance to leave the office, though, it had one failure. About three weeks into using it, a thin, vertical black line appeared down the left side of the screen. I called technical support (without identifying myself), and was told to insert my DOS 3.3 disk in the A: drive and then boot from that; the technician explained that something in my CONFIG.SYS or AUTOEXEC.BAT file might be the cause of the trouble. An odd suggestion, but I played along, and the line was still there upon rebooting.

When I innocently asked if I might not just detach and send back the screen for repair, I was informed that there was no way to tell if the problem was in the screen or with the video card. I'll certainly give the technician points for being friendly and patient, but he should have at least known that the T5200 supports an external monitor, and that I could have hooked one up to it to help identify whether the video controller or the display was at fault.

When I called Toshiba again, identifying myself as a *PC Magazine* editor, I was told that what had probably happened was that one of the wires on the plasma screen had broken. I was sent a replacement

Toshiba T5200/100

Last Reviewed: March 13, 1990, page 188.
Reason Selected: Editor's Choice.
Positive Findings: As powerful as a desktop system; with one exception, the technical support staff was friendly and knowledgeable.
Negative Findings: Generates a lot of screen heat; suffered from one display failure.

RELIABILITY
COMPATIBILITY
PERFORMANCE

screen to install myself. Most users whose systems are still under warranty, however, would have returned the machine to Toshiba's Field Service department or an authorized service provider for repair.

To be fair, other calls made to technical support met with a lot more practical success, and equally friendly help. I called at various hours, and was never kept waiting for more than two or three minutes, usually less than one.

I have a few complaints, one of which is that the display generates a lot of heat. And while I thought that in time I would get used to the soft-touch keyboard, I still

invariably hit the Insert key when I mean to hit Delete.

All in all, the T5200 has been a reliable companion. While I don't need all its computing power for on-the-road work, anyone who does will probably find the tradeoff in weight acceptable. For me, it served as a fine desktop machine, albeit one that would benefit by being attached to both a cooler external monitor and keyboard; too bad it supports only the first option.

Toshiba T5200/100
Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718-9724; (714) 583-3000.
List Price: With 2MB RAM, 100MB hard disk, 3.5-inch floppy disk drive, VGA gas plasma display, one parallel and two serial ports, modem, and carrying case, $8,897.
CIRCLE 417 ON READER SERVICE CARD

TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T3100SX

by Robert W. Kane

Five months with the Toshiba T3100SX has taught me two things: one is that I need a battery-powered portable 386-class machine; the other is that portable computing is fraught with compromises, no matter how good your CPU design. While I was pleased with the 16-MHz 386SX processor, VGA gas plasma display, 40MB hard disk, built-in 2,400-bit-per-second modem, and Resume feature on this $7,446 machine, I was less impressed by its mediocre battery life, lack of manual screen controls, and the confusing layout of the keyboard.

Toshiba wins high marks for its user-friendly easy-to-upgrade design. The test began with the installation of the 2,400-bps internal modem, which required removing two screws holding a slot cover in place, inserting the modem into the newly vacated space, reinstalling the screws, and then running the Toshiba setup software to assign a COM port to the modem. While this unit did not have built-in error correction, it nonetheless performed flawlessly with all major telecommunications programs, displaying a high degree of compatibility with the Hayes AT command set for the 2,400-bps modem.

I also installed an additional 2MB of RAM to bring the system up to 3MB. Much to my surprise, performing the memory upgrade was easy; I simply removed the screws that hold the keyboard in place, removed the keyboard, and installed the proprietary memory module. With room for three memory modules, the system can accommodate a maximum of 13MB, more than adequate for all but the most arduous applications. With the keyboard off, you also have access to the 387SX socket, making installation a snap for those needing the speed and power of a floating-point processor.

The ergonomically designed shoulder strap on the optional carrying case made it almost easy to lug around the 16-plus pounds of CPU and transformer. The wealth of pockets came in handy for collecting press materials during trade shows. Unfortunately, the Velcro strips on the outside of the case that are used to keep the external pocket flat when empty would often catch on my clothing, ruining a few of my wool sweaters. Toshiba, please take the Velcro off the outside of the carrying case.

During the course of the review, I did not experience a single hardware problem with the 3100SX. In that time, I've traveled over 20,000 miles with the machine, kicking it under airplane seats, throwing luggage on top of it in the trunk of a car, and bouncing it on my hip walking the length of Hartsfield International Airport. The 3100SX never failed to power up, never had a problem reading the hard disk, and never complained about the abuse I heaped on it.

While the 3100SX shines in both 386 performance and reliability, it did fall short of the mark in a few of the areas more specifically related to its mission as a portable. Battery life (which has been a problem in other Toshiba portables) was disappointing for the 3100SX. At the end of this evaluation, I ran the PC Labs battery rundown test, and the system logged 2 hours and 31 minutes. However, I was never able to get much more than 2 hours of running time using my standard set of applications (*Microsoft Windows* 3.0, *MS-Excel*, *MS-Word for DOS*, *Lotus Express*, and *QuickBASIC 4.5*)—even with two battery packs and power conservation enabled.

It is worth mentioning, though, that one of our contributing editors is quite impressed with the battery life on the T3100SX he owns, noting that he's used its battery power almost nightly because of the frequent summer thunderstorms experienced in his part of the country. He says that he routinely gets the advertised three hours despite heavy hard disk access and other factors that would more quickly burn up the battery of a lesser machine.

Lack of screen adjustments for brightness and contrast made the display difficult to read in certain overhead lighting situations. While the plasma display was fine in an environment like *Windows*, the Toshiba character font left much to be desired in text mode. (In all fairness, this is the same character font Toshiba uses in its other plasma-screen portables.)

Another annoyance was the keyboard. While its feel was on a par with many desktop units, the cursor keys were practically lost in a vertical column on the right. If the 3100SX was my only PC, I could probably become accustomed to that layout, but switching between it and the IBM keyboard on my desktop gave me a severe case of finger dyslexia.

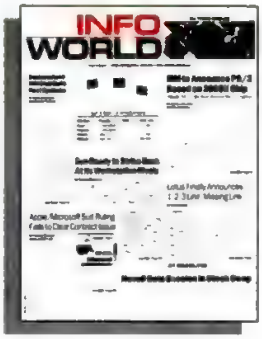
These minor quibbles aside, the fact that the 3100SX has survived this endurance drive with only a few scratches on its case shows that it's quite a survivor. It has gone a long way toward closing the gap between a portable and a desktop system, and has proven itself to be the best battery-powered 386SX you can buy—for now.

Toshiba T3100SX
Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (714) 583-3000.
List Price: With 2MB RAM, 40MB hard disk, 3.5-inch floppy disk drive, VGA gas plasma display, internal modem, one parallel and two serial ports, utilities, DOS 4.01, and carrying case, $7,446.
CIRCLE 418 ON READER SERVICE CARD

Toshiba T3100SX

Last Reviewed: March 13, 1990, page 182
Reason Selected: Editor's Choice
Positive Findings: Resume mode, easy to upgrade.
Negative Findings: Lack of manual screen adjustments, poor keyboard layout.

COMPATIBILITY



"... the fastest product we tested"
3/27/89

"... led the pack in remote control software"
6/12/90

Any Other Questions?

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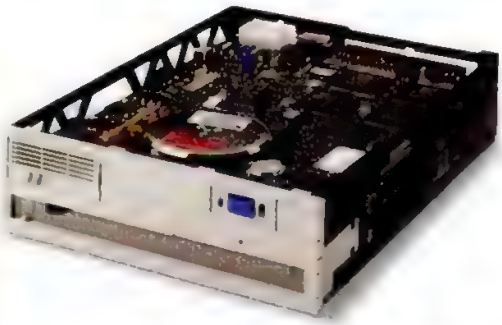

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- 5.25" half-height 44MB

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- 22 msec

Disk Shock -
- 1,000 Gs

Mean Time Between Failure -
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- Windows, NetWare, UNIX

Installed Base -
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- 3,750,000 disks

InfoWorld Product of the Year 1989

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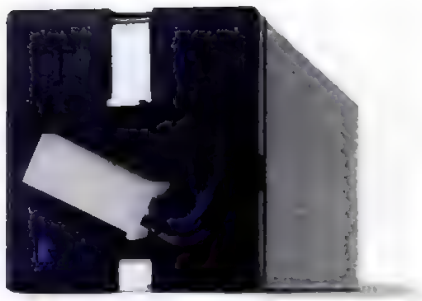

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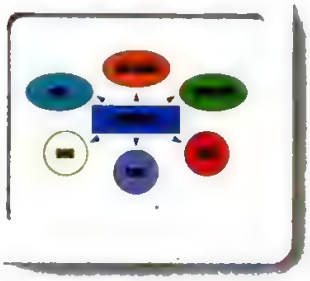

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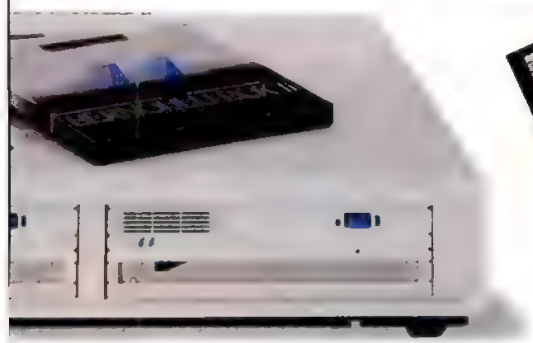

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IN FOCUS SYSTEMS INC.

In Focus 480C PC Viewer In Focus 480CX PC Viewer

by Robin Raskin

In most areas of the PC business, technology is rapidly changing. With LCD panels, change seems to be the only constant. Witness the In Focus 480C PC Viewer, whose technology leapfrogged three times since I began this endurance review.

Six months ago, when I was handed the $3,995 In Focus 480C PC Viewer, it was a state-of-the-art device—a true color LCD that projected eight colors at 640- by-480-dpi resolution. While black-and-white projection panels looked boring in contrast, the truth of the matter was that the eight-color LCD images I was getting were . . . um . . . less than vivid.

Within a few months of that product's arrival, In Focus sent me its 64-color LCD. The $4,495 64-color 480CX was marginally better because I was able to get more colors from a VGA display, but it was still not a device for top-notch presentations. Most recently, I got a very brief glance at the luscious new 5000CX, In Focus's 5,000-color LCD. (The company continues to sell the older models in the line.)

The project began as an exercise in futility, since the eight-color unit was simply not adequate for my VGA presentations. Images I created on a VGA screen with 256 colors looked crummy when output to the eight-color device. Additionally, I would often project an image only to find that I couldn't display VGA slides containing titles, bullet points, and clip art without losing one or more of these elements, depending on the colors I'd chosen. Ultimately, I found myself having to remake images specifically for output to the LCD panel's limited colors. Even though the system has a built-in color palette toggle to maximize your chances of seeing as many colors as possible, it was insufficient. With the 64-color panel, I still had to fiddle with the palette, especially when the presentation relied on images from many sources.

Made of three LCDs (cyan, magenta, and yellow) sandwiched together, the 480C LCD uses a subtractive color process (removing color from white pixels). The 64-color 480CX uses the same three LCDs, but its newer technology lets each of the panels have four levels of gray. The $5,995 5000CX also uses the same three panels, but packs 17 gray shades (actually 16 gray and 1 brightness) onto each panel, for a total of 5,000 colors. This last system enabled my endurance test to end on a happy note; in fact, the 5000CX is the first LCD technology I would consider buying. Its images projected with startlingly good color and were quite bright.

Even though the 480C and the 64-color CX model don't come with a carrying case (an optional cloth bag is available for $129), I carted these units everywhere in their cardboard boxes with carrying handles. Wherever I went I was plugged in quickly and able to adjust the sync, contrast and palette for a reasonable (though not always optimal) display.

My biggest problems with the 480C and the 64-color CX stemmed more from external sources than from the units themselves. One problem was the diversity of overhead projection units out there. In Focus sells its own wonderfully compact overhead projector that uses a special 360-watt quartz lamp and puts out 3,000 lumens. Other overhead projectors I used weren't nearly as bright, and their light tended to be concentrated in the middle of the unit. Not only would I lose the edges of my images, but sometimes these overheads simply didn't emanate enough light to make images legible. The only way I could really trust the presentation was to take both the overhead and LCD with me—pushing the limits of portability and my own strength.

> The only way I could really trust the presentation was to take the In Focus LCD *and* overhead with me—pushing the limits of portability and my own strength.

This endurance test has made me more convinced than ever that there is a right media for each type of presentation. LCDs will never be the optimal display technology for all presentations; for instance, I still prefer slides for my most formal (and controlled) presentations. And while all the LCDs have the advantage of portability, even the 5000CX displays less-vivid images than a three-gun data projector.

However, the 480C PC Viewer, with which I spent the most time, proved incredibly trustworthy and highly portable, as did the 480CX. (I didn't have the 5000CX long enough to make a judgment on its ruggedness, but if the other two products are any indication, it should prove equally tough.) As a die-hard PC user, compatibility wasn't a big issue to me, but others will appreciate that all the In Focus panels accept signals from MAC, MACII, CGA, VGA, and EGA. Offering maximum flexibility, these systems can't be beat for PC training sessions.

By the time you read this article, In Focus should have launched LiteShow, a small add-on box that captures, organizes, sequences, and presents PC images. The unit gets hooked up and drives the LCD panel, which means you can leave the computer at home, but still take your show on the road.

In Focus 480C PC Viewer and In Focus 480CX PC Viewer

Last Reviewed: February 27, 1990, page 198 (480C PC Viewer).
Reason Selected: Honorable mention (480C PC Viewer).
Positive Findings: Both offer portability and decent color; easy to adjust and calibrate.
Negative Findings: Images not as sharp as slides or data projectors; good overhead projector required.

RELIABILITY / COMPATIBILITY / PERFORMANCE

480C PC Viewer
480CX PC Viewer
In Focus Systems Inc., 7649 SW Mohawk St., Tualatin, Or. 97062; (800) 327-7231, (503) 692-4968.
List Price: $3,995 (480C); $4,495 (480CX).

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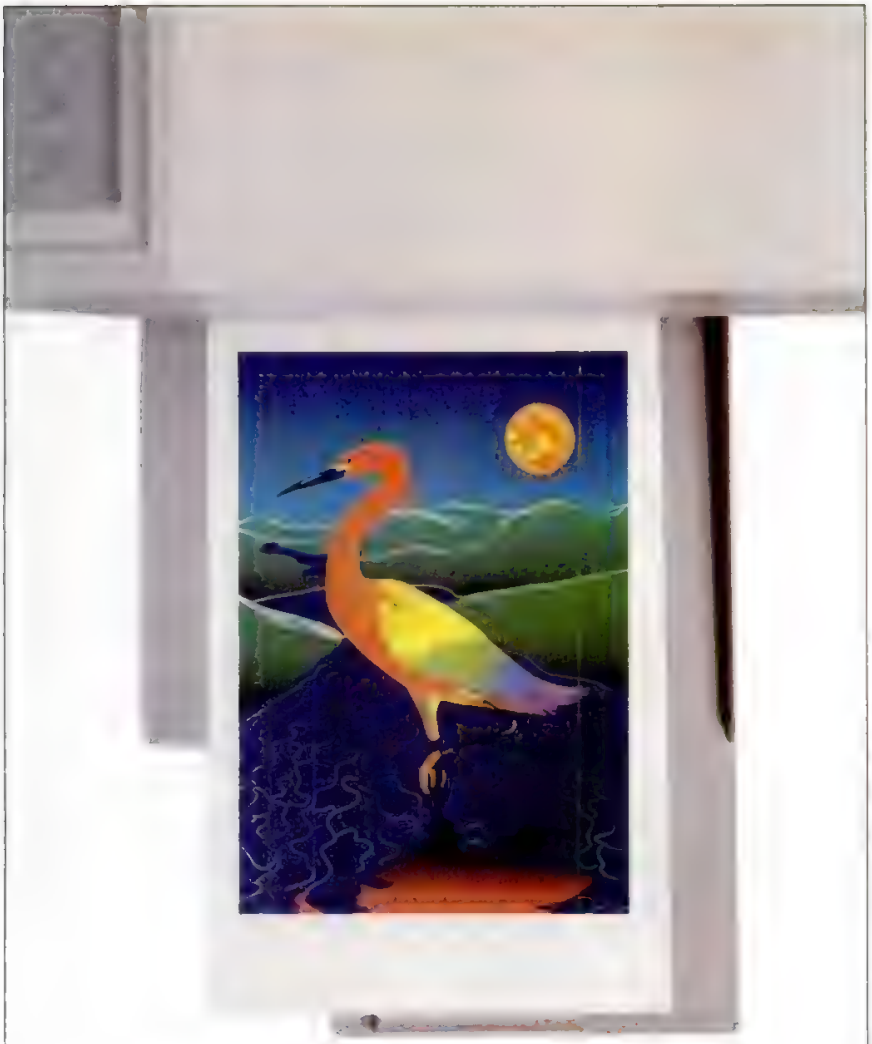

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NVIEW CORP.

ViewFrame II+2

by Robin Raskin

When we last reviewed LCD panels ("LCD Panels: 12 for the Road," February 27, 1990), color was the exception to the rule. Ten months later, color LCDs are coming down in price and up in performance, but when it comes to crispness and clarity the black-and-white display of the Editor's Choice ViewFrame II+2 is still quite appealing. The unit's extra niceties—the hard-shell carrying case, remote infrared keyboard option ($395), and three sets of cables for Macintosh, CGA/EGA, and VGA monitors—completed this affordable integrated unit.

The ViewFrame displays images using eight shades of gray. I was able to map these shades as closely as possible to images created on a VGA screen and containing 256 and 16 colors by fiddling with three small colored knobs on the side of the panel that correspond to red, green, and blue. Even though nView provides a utility disk to help you get the best settings, I found that when I displayed VGA 16-color graphics images with the ViewFrame, some of the detail in my artwork got lost unless I set the controls on an image-by-image basis (theoretically, you should only need to set these once during a presentation). When I presented textual material, or demonstrated a single application, I fared much better since the original colors did not differ so much from frame to frame. I also found that by eliminating the majority of color from the LCD, I was left with a monochromatic pixel pattern display which was quite effective for presentations that didn't use colored graphics.

In addition to the color controls, the ViewFrame allows for adjusting contrast and shifting the image horizontally or vertically. The controls were clearly labeled on the top of the panel, but adjustments are made by twisting cylindrical knobs that jut out of the side. My experience was that making these adjustments during live presentations could be difficult.

Similar to the In Focus LCD, the nView's LCD performance depended on the quality of my overhead projector. Many standard overhead projectors simply

did not emit enough light, or the light caused a ring in the center and darkened edges on the viewing area. Only a top-notch projector with a strong light produced adequate results.

Projecting images with dark color backgrounds also proved to be a problem. Over time, especially as the unit heated up, the backgrounds would shimmer and weave, making it terribly hard on the eye. Unless I

nView ViewFrame II+2

Last Reviewed: February 27, 1990, page 204.
Reason Selected: Editor's Choice.
Positive Findings: Cheap and portable; compatible with everything; sharp and crisp image.
Negative Findings: Lacks color; prone to ghosting; poor color mapping when switching between applications.

RELIABILITY
COMPATIBILITY
PERFORMANCE

played with the controls on a per-image basis, I experienced ghosting and occasionally, after the unit was on for a while, a black line (one pixel wide) would appear on the screen until I readjusted the colors.

Probably the best part of my nView experience was the nView Toteboard, the remote infrared keyboard, which renewed my faith in infrared technology. A small receiver unit hooks into the keyboard socket on your PC and you walk away with an ultra-light portable keyboard that's half the size of a regular one. I found the infrared responsive, even when I was positioned at strange angles.

Together, the totable keyboard, heavy-duty case (which can double as luggage on your next trip), and affordable panel make an attractive package. The only problem is that black and white simply won't cut it for the most demanding presenter, who may be more interested in the company's recently released, $2,995 16-"simulated"-color LCD.

ViewFrame II+2
nView Corp., 11835 Canon Blvd., Newport News, Va.; (800) 736-8439.
List Price: $1,995; $395 for remote keyboard.

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IOMEGA CORP.

Bernoulli Box II

by Lori Grunin

If asked to configure my ideal system, an Iomega 44MB Bernoulli Box II would definitely be on my list.

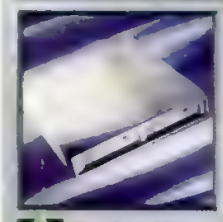
I've been using the $2,599 BBII for about a year now. For the first eight months or so it functioned as the main storage medium for an IBM AT; although I always booted from my hard disk, I ran all my programs from and stored all my data on the cartridges. The 32-millisecond drives aren't terribly fast compared with today's hard disks—the newer 22-millisecond, SCSI-based Universal Dual Drive BBIIs improve upon that—but I found it more than adequate for playing disk-intensive games as well as for running less-demanding applications such as *XyWrite*, *Instant Recall*, and *Lotus 1-2-3*. It also provided a great way to transport large graphics files from one system to another. Although benchmark tests might show otherwise, I was never able to tell whether the bundled version of Multisoft's generally excellent *PC-Kwik* disk caching program really made an impact on performance.

Once I switched from my AT to a 25-MHz 80386 with a larger hard disk, my BBII became a storage area for overflow data and applications, as well as my backup device. (The box comes with *Backit*, but I used the more flexible Norton *Backup* software.) Since my hard drive is broken up into 32MB partitions, backing up each partition onto a separate cartridge is a snap. For those with non-partitioned hard disks, this system would of course be less effective than a streaming tape backup device; it beats floppies by a longshot, though.

Not once did I encounter a software compatibility problem, even when dealing with pre-release software or hardware-sensitive programs such as *Windows* 3.0. Since it doesn't use an IRQ, I experienced no hardware conflicts, either.

On the other hand, I did run into a problem with chirping cartridges—no physical damage, but a very irritating noise that sounded as if a bird were trapped in the unit. The first time it happened, technical support sent me a replacement cartridge overnight via Federal Express (with no knowledge of my position at *PC Magazine*). More recently, when another of my cartridges began chirping, an Iomega representative gently pointed out that if I cleaned the drive heads once a month—as the documentation suggests—the chirping might stop. He also told me not to leave the cartridges constantly spinning in the drive. The latter finally quieted the chirp, but put a serious dent in the "transparent operation" of the unit; in order for the drive to re-recognize the cartridge, you have to pull it out and push it in again. Iomega says that only about *one percent* of the cartridges suffer from this problem, although an older batch (of which mine may have been a part) had a slightly higher incidence rate.

Bernoulli Box II



Last Reviewed: September 13, 1988, page 250.
Reason Selected: Editor's Choice.
Positive Findings: Infinitely expandable mass storage, transparent operation; easy to use.
Negative Findings: A short cable restricts location of the unit.

RELIABILITY
COMPATIBILITY
PERFORMANCE

More seriously, after about six months of use, the unit trashed some important files on one of my cartridges (in one of those teeth-grinding episodes that teaches you why backing up is so important). Iomega was surprised at this turn of events, and although I sent them both the drive and cartridge for their inspection, I was never informed as to the cause (although I made many attempts to find out). Whether the fault lies with the unit or the vagaries of the DOS FAT system remains a mystery. As warranty policy dictates, they sent me a replacement unit and I have had no problems since.

As one of those people who constantly finds herself short of hard disk space, the BBII is a godsend; for a little over $2 a megabyte—the mail-order price for a tri-pack of 44MB cartridges is hovering around $300—I have an infinite amount of extra storage capacity. The BBII has really spoiled me for life. I simply can't envision working without it.

Bernoulli Box II
Iomega Corp., 1821 West 4000 South, Roy, Utah 84067; (801) 778-1000.
List Price: $2,599.

CIRCLE 421 ON READER SERVICE CARD

PLUS DEVELOPMENT CORP.

Passport

by Tom Unger

The Plus Development Passport won an Editor's Choice in our September 13, 1988, issue for its now-legendary versatility and its ease of installation and use. Indeed, this $1,454 2.5-pound, 1.3-by-5-by-7-inch (HWD) removable hard disk, with its 28-millisecond access time and patented AIRLOCK automatic head-parking system, has become a standard by which all removable hard disks are measured.

As advertised, the Passport installed simply and quickly. I secured the ISA-bus RLL controller card and the single-unit base housing into my 286-based PC's Limited computer with the help of only one small screwdriver. (Plus makes a controller for MCA machines as well.) I used the excellent instruction manuals to partition, format, access, and use the disk. For the only question I did have, concerning a conflict between the hard disk already installed in the computer and the Passport, Plus Development's able technical staff helped by pointing me to a reference in the documentation I had missed.

I followed the installation with some months of using the Passport as a boot disk, copying the contents of other hard disks to it in repetitive fashion, reformatting, repartitioning, recopying, adding and erasing files, running access-intensive database and communications programs from it, and using disk-defragmentation programs on it—in general, doing all the things you'd normally do to a hard disk on a system that sees a lot of different software and uses. Its 28-ms. access time theoretically can't compare with the likes of the 16-ms. hard disks now in existence, but in practice, I never felt the speed difference. Additionally, during all this time, the Passport acted just like any steady, unflappable, screw-mounted 40MB hard disk. It stored and delivered my data without so much as a cough.

Perhaps the greatest danger to remov-

able hard disks, in particular, is plain old gravity. Plus Development advertises a 150G shock rating. In order to test this, I devised a number of scientific tests you may not want to try at home—at least not on purpose. First I tried our highly scientific "drop it on the desk" test. Not even a scratch—and the thing booted my computer every time. Next, I resorted to the "drop it on the floor" test. Again, the Passport whirred away in the face of adversity.

I upped the ante with a special "cloth-briefcase" test, which consisted of one full month's travel to and from the *PC Magazine* offices in the bottom of my nylon carry-bag *sans* protective case—via the New York City subway system. The Passport fared better than I did, surviving heat, vibration, metal turnstiles, the occasional sprint to the train, and one vicious kick by an angry-looking man in a business suit. Each morning it booted my computer as if it had never left its half-height home.

As a final test, I sent my Passport on separate vacations to three locations around the country via overnight Federal Express. In fairness, this time I enclosed the little beast in its protective ABS plastic case and that in a sturdy box. Each time it returned, the box looked considerably less sturdy, but the Passport and its protective case looked—and acted—just fine.

Not only did the Plus Passport prove itself an able survivor, it was quite useful. Sensitive files could be removed for the night or weekend, taken with me or locked away with confidence that they'd be waiting the next time I needed them. As far as data storage is concerned, confidence is the name of the endurance game. It's a game the Plus Passport appears to have won handily.

Passport

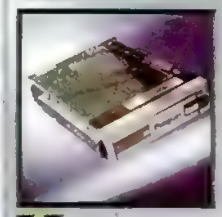
Plus Development Corp., 1778 McCarthy Boulevard Milpitas, CA 95035-7421; (408) 434-6900.

List Price: with one adapter kit, base housing, and 40MB hard disk, $1,454; additional base housing, $349; dual external chassis with two base housings (no hard disks), $1,008; 20MB hard disk, $595; 40MB hard disk, $795.

CIRCLE 422 ON READER SERVICE CARD

PC MAGAZINE ENDURANCE TESTS PORTABLE COMPUTERS

Passport



Last Reviewed: September 13, 1988, page 258.
Reason Selected: Editor's Choice.
Positive Findings: Takes a beating without mechanical failure of any kind.
Negative Findings: The only hardware conflict—easily resolved—turned out to be the result of missing a reference in the documentation.

RELIABILITY
COMPATIBILITY
PERFORMANCE

TANDON CORP.

Tandon Ad Pac and Personal Data Pac

by Stuart R. Greenberg

The Tandon Personal Data Pac with its 30MB of storage space has spent most of the testing period in the 4.5-by-6-by-10.5-inch Ad Pac docking unit mounted on top

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What's the best way to catch the new Lotus

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of the Dell 310 in my office, taking time out only for excursions meant to test its durability. It seems to have taken nicely to the steady diet of data I've been feeding it, faithfully—if not always speedily—performing all the tasks I've asked.

Installing the $770 Ad Pac/Data Pac combination in my system proved to be as simple as installing any standard hard drive. The ISA-bus RLL controller card was inserted in my machine and a cable attached from the back plate on the card to the Ad Pac docking unit. A second Ad Pac unit can be installed by attaching a daisy-chain connector between the units. The step-by-step installation procedures accompanying the Ad Pac were clear and well illustrated.

Tandon's version of DOS directly supports the Ad Pac. Users like myself who have non-Tandon DOS have to include a DEVICE= statement in their CONFIG.SYS file to load a device driver at boot-up. This is quite common these days, and using *386Max* I loaded the driver into high memory. I also needed to run a program to configure the Ad Pac to run as the second drive controller in my system. The parameters were easy to set and I was up and running in a few minutes.

Tandon Ad Pac and Tandon Personal Data Pac

Last Reviewed: September 13, 1988, page 266.
Reason Selected: Editor's Choice.
Positive Findings: Comfortable size and weight for carrying around; easy to set up and run; rugged.
Negative Findings: Lacks a way to manually eject the drive.

RELIABILITY
COMPATIBILITY
PERFORMANCE

Although the 2-pound, 10-ounce Data Pac was called fast in our September 13, 1988 review of removable media, I found it to be noticeably slow by today's standards. Its rated access time is 85 milliseconds, aided by a 128K cache on the controller card. I copied several directories from my internal hard disk drive onto the unit and went about my daily business of programming the PC Labs benchmark programs. This can be a very disk intensive operation and on the Tandon system, it took a significantly longer time to do my work. A quick run of the PC Labs DOS File Access test showed the Data Pac to be two to three times slower than my 19-ms. internal drive, with random accesses taking the biggest performance hit. The slower speed will be most noticeable in applications that make heavy use of the disk, such as databases. Word processing and spreadsheet applications generally load their data into memory once and will be less affected by a slow disk drive. A software disk cache to supplement the controller's onboard cache can speed up applications that access the same data repeatedly.

I half expected the Hard Drive Police to take me away in handcuffs for the abuse I gave my Data Pac. I tossed the 2.5-by-4.7-by-7-inch (HWD) drive into my soft sided brief case, threw it onto my car seat for weekend excursions, and knocked it about on the train trip to and from work. It pained me, a person who religiously parks the heads on drives before moving machines,

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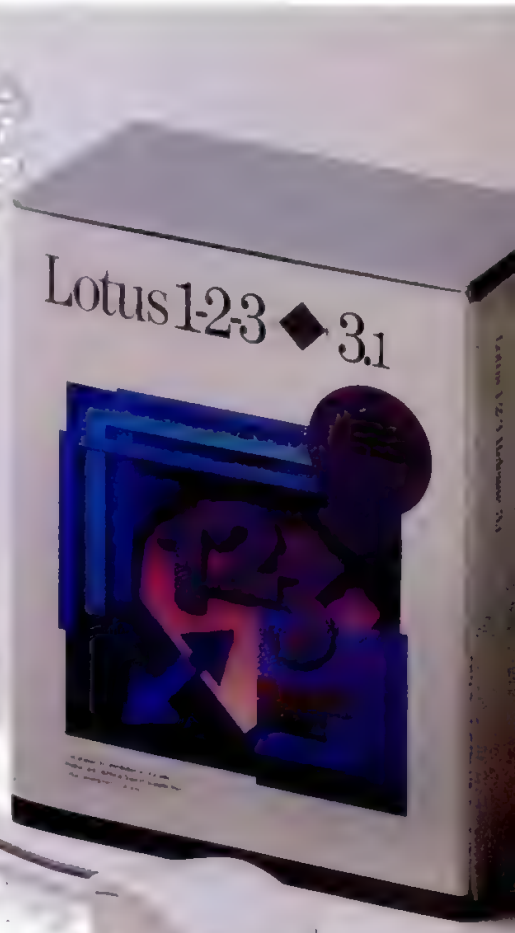

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to drop this drive from tower case and table top heights. Yet after each torture the Data Pac performed flawlessly.

Software compatibility is important to me when choosing a drive. The Ad Pac worked well on my system under the 4DOS COMMAND.COM alternative and *386Max* memory manager. I used *Norton Utilities* to explore the contents of the disk, defragment the files, and test the drive after my many abuses. Everything always worked perfectly.

Tandon's device driver attaches a set of hotkeys for ejecting the Data Pac drive. The keys conflicted with my editor program and although I could have easily redefined them, I opted to disable this feature and use the DPEJECT utility at the DOS command line to eject the drive. Unfortunately, the drive cannot be ejected without the hotkey or DPEJECT. If your system goes down, the controller, docking unit, and drive must be installed on another system to eject the Data Pac.

> Compared with a traditional network interface card, Xircom's Pocket Ethernet and Token-Ring Adapters cost more, run slower—and are wonderful.

Except for its slow speed and lack of manual eject, the Tandon Ad Pac/Data Pac combination proved to be a rugged, hard worker. The drive unit was a comfortable size and weight for carrying around and I didn't have to pamper it in transit. For the executive with a second machine at home or an office where people share PCs, the Tandon unit provides the convenience of popping in a drive that is fully configured to an individual's needs.

Tandon Ad Pac
Tandon Personal Data Pac
Tandon Corp., 405 Science Drive, Moorpark, CA 93021; (805) 523-0340.
List Price: Ad Pac for AT class machines, $445; Ad Pac for XT class machines, $395; 30MB Personal Data Pac, $325; 40MB Personal Data Pac, $414.
CIRCLE 423 ON READER SERVICE CARD

POCKET NETWORK ADAPTERS

XIRCOM INC.

Xircom Pocket Token-Ring Adapter
Xircom Pocket Ethernet Adapter

by Bill Howard

Compared with a traditional network interface card, Xircom's Pocket Adapters for connecting a laptop or portable PC to a network cost more, run slower—and are wonderful. Almost no one who owns a portable and regularly uses a network—Xircom offers token ring, Ethernet, and Arcnet adapters—should be without one. The 5-ounce, 5-inch units plug right into your parallel port, so you don't need an internal slot or expansion chassis.

Of course, it would be impossible to test the adapters on every portable in existence, but in extended use, the Xircom Token-Ring and Ethernet adapters proved hassle free when connected to a Toshiba T3100SX, a Compaq LTE 286, and an NEC ProSpeed 286. If you benchmark test them, you'll find about 65 to 90 percent of the throughput of a good expansion-bus network interface card (Token-Ring is faster than Ethernet). But in day-to-day use, I didn't notice much speed difference—certainly nothing worse than the minute-to-minute variations you find when your network is actively serving multiple users.

More than a few times, I've also turned to the Xircom adapters as the Token-Ring or Ethernet network interface card of choice for a temporary network connection for *desktop PCs*. Here's why, in a nutshell: They're incredibly simple to set up and use. You don't have to open up the machine, installation is switchless and a breeze, and there are no interrupts or memory address conflicts to worry about. Additionally, ready-to-go drivers for Novell *NetWare* were included, as were NETBIOS support for IBM *PC LAN*, Banyan *VINES*, and Artisoft *LANtastic*, with more on the way. The Ethernet version has additional drivers, including *LAN Manager* and 3Com *3+* (the Arcnet version has a few less). You'll be up and running on the network in five to ten minutes from the moment you open the box. The manual may be a bit terse for some end users who use but don't really understand networks; for anyone else, everything you need to know is logically laid out.

Xircom Pocket Token-Ring Adapter
Xircom Pocket Ethernet Adapter

Last Reviewed: November 31, 1989, page 38.
Reason Selected: Technical Interest.
Positive Findings: Works with most portable PCs; excellent for temporary networking of desktop PCs
Negative findings: Performance slightly worse than internal network cards; extends depth of laptop or desktop.

RELIABILITY
COMPATIBILITY
PERFORMANCE

The Xircom adapters look like pocket modems or packs of cigarettes. Two knurled screws attach the adapter to your parallel port. There's also a transformer cube (supplied) that provides 12 volts DC to power the adapter; sure it was clunky, but there's no easy way to draw power from a parallel port. Connecting an adapter to any of the machines took only about 30 seconds.

The Xircom adapter you'll buy depends on your network operating system and media cabling. Prices range from $395 (Arcnet) to $595 (Ethernet) to $845 (Token-Ring). Those prices proportionally reflect the relative prices of internal adapter cards. Expect to see prices come down as technology advances and as Xircom sees competition from vendors like DLink.

The only two hassles I encountered can be readily resolved. The adapter plus the media (network cable) connector extended the depth of laptop or desktop PCs by at least 6 inches; you'll likely want to buy a short (8 inches or less) flexible cable to angle the adapter off to the side. It should have been included with the Xircom adapter and may in the future. And, of course, I also lost the use of the parallel port on the

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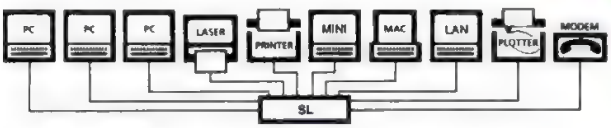

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systems to which I connected it; Xircom was due to ship in October a $95 printer pass-through adapter called the Port Multiplexor, which will let you keep both the network adapter and a printer attached to your parallel port.

If only every product worked as well as Xircom's network adapters . . .

Xircom Pocket Token-Ring Adapter
Xircom Pocket Ethernet Adapter
Xircom Inc., 22231 Mulholland Highway, Suite 114, Woodland Hills, CA 91364; (818) 884-8755.
List Price: $845 (token-ring); $595 (Ethernet); Xircom Pocket Arcnet Adapter, $395.

CIRCLE 424 ON READER SERVICE CARD

PORTABLE PRINTERS

EASTMAN KODAK CO.

Kodak Diconix Model 150 Plus

by Jonathan Matzkin

It's the world's oldest cliche, but good things *do* come in small packages. Kodak's Diconix Model 150 Plus portable printer ($519 in its parallel version) is all the proof you need that small is indeed beautiful, but this tiny ink jet has more than just small size to recommend it. I've had our test sample for some months now, and I've been consistently impressed with the intelligence and thoughtfulness not only of its design, but also of its supporting materials.

True road warriors—people who work on tray tables, on hotel room "desks," and in crowded airport lounges—would be pleased enough with the Diconix simply because it is so tiny. Everywhere I set it up, I got the same reaction: People looked, blinked, and said something like, "That's a printer?" Yep, it's a printer, and one that fit in the side pocket of my Toshiba T1000 case. I had to rearrange the contents of the case a bit to find room for the Diconix's power supply/charger unit, but nevertheless there was space left over for its manuals and a spare ink supply cartridge.

The spare ink supply and printhead are a single unit. When I ran out of ink, I simply lowered a retaining bar, popped in a new cartridge and blotter, and snapped the retaining bar back into place. The whole process took about a minute. While it's

ENDURANCE TESTS
PORTABLE COMPUTERS

simple enough to accomplish on a moving train, this procedure might be better left to the calm, motionless environment of a hotel room, because the cartridge must be primed before it's inserted into the machine. This involves poking a straightened paper clip into a hole at one end, and forcing a drop of ink onto the printhead. Cartridges must also be primed after a long period of disuse while installed. I managed to

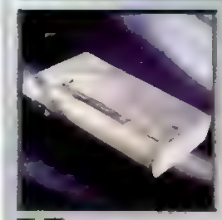
> The Diconix is almost alone among portable printers in being truly usable on trains or planes, but it's still more at home working on a stationary tabletop.

get ink on my hands at least once, and I shudder to think of what a clumsy move could do to my best suit. That's a minor complaint though.

The replacement cartridges are cleverly packaged in sealed foil containers; they were rugged enough to absorb a fair amount of abuse as I lugged them around. I was able, however, to rupture both the container and the cartridge itself by deliberately stepping on one packaged spare—that's an extreme test, but some care is in order when handling or transporting these spare ink supplies.

On my last trip to Washington via the Amtrak Metroliner, I was able to set up and print with the Diconix with no more than the usual hassles associated with getting PC, printer, and cable to work together. Realistically, though, this isn't possible on a single coach-sized tray table. Since I was fortunate enough not to have a seatmate, I was able to allot one tray to my Toshiba and one to the Diconix, and merrily print out a manuscript I was working on. The Diconix device is almost alone among

Kodak Diconix Model 150 Plus



Last Reviewed: November 14, 1989, page 327.
Reason Selected: Editor's Choice.
Positive Findings: Design makes it truly usable on trains and planes; batteries are easily replaceable.
Negative Findings: Changing ink cartridges can get messy; draft mode a little faint; some wicking in NLQ and Quality modes.

RELIABILITY
COMPATIBILITY
PERFORMANCE

portable printers in being truly usable on either trains or planes, but it's still more at home working on a convenient, stationary tabletop.

On readily available plain paper, the Diconix produced respectable- to good-quality print. The characters in draft mode were a little faint, but this was more than compensated for by the increased draft output speed. The NLQ and Quality modes produced dark, attractive characters, but I consistently noticed some wicking in plain paper use. Obviously, coated ink jet paper produces truer letter-quality results, but special paper is just one more thing to remember when you're running around on a series of sales calls.

A significant plus is the Diconix's use of readily available nickel-cadmium batteries. All rechargeables fail eventually, and replacements for the Diconix are as close as the nearest electronics or business supply store. That gives the Diconix an advantage over the Canon BJ-10e, which uses a sealed, proprietary pack for battery operation.

While the new Canon merits a hard look because of its excellent output quality and optional sheet-feeder, the Diconix is noticeably smaller and somewhat lighter. It also seems a bit more ruggedly constructed. For users who must print on the go, the Diconix Model 150 Plus remains the machine of choice. ■

Kodak Diconix Model 150 Plus
Eastman Kodak Co., Personal Printer Products, 901 Elmgrove Rd., Rochester, NY 14653; (800) 344-0006.
List Price: Parallel version, $519; serial version, $539 (batteries not included); replacement plain-paper printhead/ink supply cartridge, $14 (singly); ten-pack $140.

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This preconfigured system includes all the features of our base system with:

- 512K RAM *(expandable to 8MB)*
- 40MB/25Ms Hard Drive
- 12" Mono Graphics Monitor
- Hercules Compatible Mono Graphics Card
- 1.2MB or 1.44MB Floppy Drive
- High Resolution Mouse

16MHz **$999**

20MHz **$1,099**

All Systems also Include: On-Site Service by TRW[1], Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features
- 80286-16, 80286-20 operating at 16MHz or 20MHz with Zero Wait States
- 512K RAM expandable to 8MB on the System Board
- 1:1 interleaved Hard/ Floppy Drive Controller, with 1MB second disk transfer rate
- 1 Parallel and 2 Serial Ports
- High capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support

Standard Features Cont.
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL,3COM, and PCNET compatibility
- Built in System Board LIM 4.0EMS hardware
- 7 Slot Motherboard Design (5 16bit & 2 8bit)
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options
- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options
- 40MB/25MS
- 89MB/19MS
- 120MB/17MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options
- Mono Graphics
- VGA Mono
- VGA Color (640 x 480)
- Super VGA Color (1024x768)

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[1]TRW-National Computer Maintenance Services-Free on site service for 386/SX, 386/DX, and 486's for customers located within a 100 mile radius of any of over 200 TRW service centers. On site service for 286's available at extra cost. Call for details.

PCM 9-22

Rock Solid Warranty,

PC BRAND

Rock Bottom Price.

"The PC Brand 386/SX-16 performed at least as well as the far costlier Compaq... We simply began marveling at what is surely the best bargain in personal computing."

-Computer Buyer's Guide, 386SX-16 Product Review

386/SX-16 Non Cache and 386/SX-20 Cache ISA Systems

386/SX-16 Non Cache and 386/SX-20 Cache Base Systems

Customize with the Video and Hard Drive options of your choice

- True 80386SX Processor operating at 16MHz or 20 MHz with Zero Wait States
- Landmark Speed 18.3MHz *(386/SX-16 Non-Cache)*, 28.9MHz *(386/SX-20 Cache)*
- Norton SI 18.7 *(386/SX-16)*, 23:4 *(386/SX-20)*
- 512K RAM *(expandable to 8MB)*
- 16K CPU RAM Cache *(SX-20 only)*
- 1.2 MB or 1.44 MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

SX-16 $799

SX-20 $899

386/SX-16 Non Cache and 386/SX-20 Cache Super VGA Packages

This preconfigured package includes all the features of our base system with:

- 2MB RAM *(expandable to 8MB)*
- 40 MB/25Ms Hard Drive
- 14" Super VGA *(1024 x 768 Resolution)* Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2 MB and 1.44 MB Floppy Drives
- High Resolution Mouse

SX-16 $1,947

SX-20 $2,047

All Systems also Include: Free On-Site Service by TRW†, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

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Standard Features
- True 80386/SX Processor operating at 16 MHz or 20 MHz with Zero Wait States
- 512K RAM expandable to 8MB on System Board
- 16KCPU RAM Cache (SX-20 only) with Posted Write and Writeback Logic
- 1:1 Interleaved Hard/Floppy Drive Controller with 1MB/second disk transfer rate
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery

Standard Features Cont.
- 1 Parallel and 2 Serial Ports
- 80387/SX CoProcessor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- 8 Slot Motherboard Design (5 16bit and 3 8bit)
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options
- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options
- 40MB/25MS
- 89MB/19MS
- 120MB/17MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options
- Mono Graphics
- VGA Mono
- VGA Color (640x480)
- Super VGA Color (1024x768)

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PCM 9 22

Rock Solid Support,

PC BRAND

Rock Bottom Price.

"...Flawless Compatibility, Lowest Price."

-InfoWorld, 386/33 Product Review

386/25MHz and 386/33MHz Cached ISA Systems

386/25 and 33 Cache Base Systems

Customize with the Video and Hard Drive options of your choice

- True 25MHz or 33MHz Intel 80386 CPU operating with Zero Wait States
- Landmark Speed 43.5MHz *(386/25Cache)*, 58.7MHz *(386/33Cache)*
- Norton SI 31.6 *(386/25Cache)*, 45.9 *(386/33Cache)*
- 1MB RAM *(expandable to 16MB)*
- 1.2MB or 1.44MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz $1,399

33MHz $1,599

386/25 and 33 Cache Super VGA Packages

This preconfigured package includes all the features of our base system with:

- 4MB RAM *(expandable to 16MB)*
- 120MB/17MS Hard Drive
- 14" Super VGA *(1024 x 768 Resolution)* Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44MB Floppy Drives
- High Resolution Mouse

25MHz $2,924

33MHz $3,124

All Systems also Include: Free On-Site Service by TRW[1], Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 60-Day* No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features
- True 25MHz or 33MHz Intel 80386 CPU operating at Zero Wait States
- Direct Map Cache Processor with 32K static RAM standard expandable to 64K
- 1MB RAM expandable to 16MB on the System Board
- 1:1Interleaving Hard /Floppy Drive controller, with 1MB/second disk transfer rate
- 1 Parallel and 2 Serial Ports
- 80387 or Weitek Coprocessor Support

Standard Features Cont.
- High capacity 200 watt System Power Supply
- RealTime Clock/Calendar with 5 Year Battery
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- 8 slot Motherboard design
- Medium Footprint Desktop Case with 6 Disk Drive Bays

Case Options
- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options
- 40MB/25MS
- 89MB/19MS
- 120MB/17MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options
- Mono Graphics
- VGA Mono
- VGA Color (640x480)
- Super VGA Color (1024x768)

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[1] TRW-National Computer Maintenance Services-Free on site service for 386/SX, 386/DX, and 486's for customers located within a 100 mile radius of any of over 200 TRW service centers. On site service for 286's available at extra cost. Call for details.

*60-day return for 386/33 InfoWorld Recommended System.

PCM 9-22

Rock Solid Service,

PC BRAND

Rock Bottom Price.

"The Best Low Cost Alternative Around"

-PC Magazine, 386/25 product review

386/25MHz ISA Systems

386/25 Base System

Customize with the Video and Hard Drive options of your choice

- True 25MHz Intel 80386 operating with Zero Wait States
- Landmark Speed 33.6MHz
- Norton SI 28.2
- 1MB Ram *(expandable to 16MB)*
- 1.2 MB or 1.44 MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz **$1,149**

386/25 Super VGA Package

This preconfigured package includes all the features of our base system with:

- 4MB Ram *(expandable to 16MB)*
- 89MB/19MS Hard Drive
- 14" Super VGA *(1024 x 768 Resolution)* Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44 Floppy Drives
- High Resolution Mouse

25MHz **$2,553**

All Systems also Include: Free On-Site Service by TRW†, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features

- True 25MHz Intel 80386 CPU Operating with Zero Wait States
- 1MB RAM expandable to 16MB on the System Board
- 1:1 Interleaving Hard /Floppy Drive Controller, w/ 1MB/ second disk transfer rate
- 1 parallel and 2 serial ports
- High Capacity 200Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor Support

Standard Features Cont.

- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium Foot Print Desk Top Case with 6 Disk Drive Bays

Case Options

- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options

- 40MB/25MS
- 89MB/19MS
- 120MB/17MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options

- Mono Graphics
- VGA Mono
- VGA Color (640x480)
- Super VGA Color (1024x768)

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PCM 9-22

Rock Solid Performance,

Rock Bottom Price.

"PC Brand is the L.L. Bean of Personal Computer Mail Order...PC Brand wants no unhappy customers... It's service and support policies help to insure that."

-Personal Computing, 10 Best Mail Order Companies

486/25MHz and 486/33MHz Cached ISA Systems

486/25 and 33 Base Systems

Customize with the Video and Hard Drive options of your choice

- True 25MHz or 33MHz Intel 80486 CPU operating at Zero Wait States
- Landmark speed114.1MHz *(486/25)*, 150MHz *(486/33)*
- Norton SI 41.5 *(486/25)* 51.5 *(486/33)*
- 1MB RAM *(expandable to 32MB)*
- 1.2MB or 1.44MB Floppy Drive
- 101 Key Click/Tactile Keyboard
- 1 Parallel and 2 Serial Ports

25MHz **$2,499**

33MHz **$3,499**

486/25 and 33 Super VGA Packages

This preconfigured package includes all the features of our base system plus:

- 4MB RAM *(expandable to 32MB)*
- 120MB/17Ms Hard Drive
- 14" Super VGA *(1024 x 768 Resolution)* Color Monitor
- 16 Bit High Performance VGA Card with 512K Video RAM
- Dual 1.2MB and 1.44MB Floppy Drives
- High Resolution Mouse

25MHz **$3,999**

33MHz **$4,999**

All Systems also Include: Free On-Site Service by TRW†, Our Unique 5 Year Warranty, Unlimited Toll-Free Service and Support, Our 30-Day No Risk Money Back Guarantee and Volume Purchase Discounts.

PC Brand Will Customize Any System to Your Exact Specifications, with name brand products from vendors like NEC, Paradise, ATI, Novell and many others, at outstanding prices. Call for quotation.

Standard Features
- True 25MHz or 33MHz Intel 80486 CPU operating at Zero Wait States
- 1MB RAM expandable to 32MB
- Built-in 8K 4-Way Set Associative Cache
- Built-in Intel 487 Numeric Coprocessor
- Optional 128K or 256K auxillary CPU Cache Card
- Optional Weitek Card
- 1:1 Interleaved Hard/Floppy Drive Controller with 1MB/second disk transfer rates
- 1 Parallel and 2 serial Ports
- High capacity 200 watt System Power Supply

Standard Features Cont.
- Real Time Clock /Calander with 5-year Battery
- 7 Slot Motherboard Design with one 32bit proprietary Zero Wait State Slot
- Industry Standard BIOS with MS/DOS, OS/2, XENIX, UNIX, NOVELL, and 3COM and PCNET compatibility
- Medium footprint desktop case with 6 disk drive bays

Case Options
- Slim Line
- Mini Tower
- Full Size Tower

Hard Drive Options
- 40MB/25MS
- 89MB/19MS
- 120MB/17MS
- 170MB/15MS
- 200MB/16MS
- 320MB/16MS
- 640MB/16MS

Video Options
- Mono Graphics
- VGA Mono
- Color VGA (640 x 480)
- Super VGA Color (1024 x 768)

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PCM 9-22B

Rock Solid Quality

At PC Brand our mission is simple: to provide you with computer systems to your exact specifications; constructed with only top quality components from the industry's leading manufacturers; at an outstanding price. The Best in the Business.

PC Magazine said it best in a recent review:"...PC Brand machines are an efficient combination of in-house engineering and top-notch off the shelve parts..."

Infoworld obviously agrees awarding their highest honor 'Recommended Product' with its quality seal of approval, to our 386/33 Cache Product.

Rock Solid Warranty.

The Best way we can stand behind our pledge to quality is to support it with the longest standing warranty in the Business. 5 Years.

Rock Solid Support.

The need for support installing specialized software, add-on peripherals, LAN's and the like is not a matter of *IF* you need it, but *WHEN*. Our job is to be there, when you need us, just a telephone call away to pitch-in and get your problem solved. That is our challenge and our committment backed by the skills and service of some of the best technicians in the business, at your service through our unlimited Toll-Free Techline program. The Best in the Business.

Rock Solid Service.

In addition to our unlimited Toll-Free Techline, If your system requires a repair there's no need to send it back or carry it in, we'll come out to your site and fix it Free-of-Charge for any 386/SX, DX or 486 Computer*

Rock Bottom Price.

With PC Brand you deal direct. No middleman, no dealers, no distributors: no 'partners in profit' to boost up the price and give you nothing in return.

At PC Brand we take their share of the profit and give it directly to you in a lower system price and in better service and support. The Best in the Business.

This formula works! And it's why more experienced PC buyers are leaving the retail channel behind and joining the ranks of tens of thousands of Satisfied PC Brand Clients. Working with the Best in the Business.

PC BRAND™

CIRCLE 303 ON READER SERVICE CARD

Finally, a computer company that specializes in satisfied customers.

Color Page Printers

Putting A Rainbow On Your Desk

by M. David Stone

Not so long ago, the phrases "high-quality color output" and "affordable price" wouldn't apply to the same printer. That began changing two years ago. And, a little over one year ago, there were enough such affordable *and* high-quality printers that *PC Magazine* covered them in a separate section of the 1989 printer issue (see "Color Page Printers: Affordable At Last," November 14, 1989).

Included in that 1989 overview were five printers from four manufacturers—the Howtek Pixelmaster, the QMS ColorScript Model 10 and Model 30, the Seiko Instruments CH-5504-PS, and the Tektronix Phaser CP. All five printers offered vibrant colors, with prices ranging from $8,245 to $15,995. And if the prices were high compared to a typical laser printer, they were also low enough to be affordable for medium-duty business presentation needs.

To make it into this roundup, printers had to be PC-compatible, print in color, use PostScript, and, of course, arrive in time for our deadline and in working condition. Four color thermal printers met these criteria—the NEC Colormate PS, the OcéColor, the QMS ColorScript 100 Model 10, and the Tektronix Phaser PX. As a possible high-end alternative, we also reviewed the Canon Laser Copier 500 (see the sidebar "The Canon Laser Copier 500: First of Its Kind"), a $49,500, 602-pound monster capable of copying color images with laser quality and upgradable (after a $30,000 dip into your wallet) to a true color laser printer.

Machines that didn't arrive in time were CalComp's announced ColorMaster Plus and the Linotype Color Printer.

PHOTOGRAPHY: WALTER CHRYNWSKI PANTONE® is a registered trademark of Pantone, Inc.

STILL LOWER PRICES

If you take the four printers reviewed here together, they establish a clear trend. Prices range roughly between $8,000 and $10,000. Include the Seiko ColorPoint PS 4, which we review in a pre-production version (see the sidebar "The Seiko ColorPoint PS 4: Still in The Wings," for more information), and the lowest price falls to around $7,000. All five printers use color thermal transfer technology, as did most of the color printers in the 1989 printer issue.

Part of the reason for the lower prices in this roundup is that the five printers are all limited to paper widths of roughly 8.5 inches, with some variation to A4, A, and Super A sizes. The high-end price of $15,995 in the 1989 printer issue was for the QMS ColorScript Model 30, which handles 11- by 17-inch, B-size paper.

Even so, much of the price difference is advantageous. For example, QMS's Model 10, which we reviewed both in 1989 (when it won an Editors' Choice) and again in this roundup, was essentially the same price in both reviews. But in 1989, this PostScript printer provided an HPGL emulation only as an option, and had only 4MB RAM standard at $9,995. In this roundup, the tested unit's $9,990 price includes the HPGL emulation and 8MB RAM. What's more, the 8MB configuration is an upgrade. The base price of the printer, with HPGL and with 5MB RAM, is $8,995.

Interestingly, the QMS Model 30 is still selling for $15,995. However, a new version—the Model 30i—was recently announced along with the new Model 10 prices, at a list price of $12,995. According to QMS, the only changes in the Model 30i are that it has an internal controller rather than the external controller of the Model 30, and it offers a hard disk as an option rather than including it standard.

One other price difference worth noting is between last year's $8,245 Seiko printer and this year's $6,999 Seiko, both of which use the same engine. Not only is this year's version about $1,250 less expensive, but it includes PostScript-compatibility in firmware, rather than providing it in a software package. (And owners of the older CH-5504-PS can upgrade to the newer ColorPoint PS 4 by buying the new controller and installing it in the printer.)

As a group, the current crop of printers offers more value for less money. As further economies of scale come into play, you can expect this downward price trend to continue.

EMERGING STANDARDS

In addition to lower prices, the five thermal transfer printers show several other trends. To start, color PostScript is now the undoubted standard for high-quality color page printers. In our 1989 overview, all five printers offered some form of a PostScript interpreter, but in two cases—the Seiko CH-5504-PS and the Howtek Pixelmaster—the interpreter was a software utility that translated PostScript into the printer's native command set.

In this roundup, every thermal transfer printer includes some form of built-in PostScript. Three printers—from QMS, NEC, and Océ Graphics—use Adobe PostScript, Tektronix uses its own version of PostScript, and Seiko uses Phoenix-Page.

Another clearly established standard is Pantone simulation, primarily of interest to graphic artists. Pantone Inc., of Carlstadt, New Jersey, and a recognized giant in the color-graphics-rendering arena, created the Pantone Matching System (a rigidly defined set of 736 colors) in 1963 to overcome color fidelity problems in conventional color graphics printing. Because of the limitations of the four-color printing process used by the printers reviewed here, none of them can exactly match Pantone's system. And, although all of them do offer Pantone-licensed simulations, each of these varies slightly from printer to printer.

All five thermal transfer printers offer 300-dpi resolution. And even though they use different inks and different print engines, their output shows far more similarity as a group than it shows differences from one printer to another. As the individual reviews show, each printer we looked at produces vibrant colors.

Which printer produces the best color? As color researchers point out, it's a truism that color preference is a highly individual issue, based on personal biases. Significantly, when we compared the output from these printers, we discovered that different people chose different print samples as providing the best-looking colors. The differences are objectively real, but the issue of best and worst is a matter of taste.

In addition to the graphics standards of PostScript and Pantone simulation, these five thermal transfer printers also suggest that standards are emerging in connection and storage options. All five printers offer a parallel port, serial port, an AppleTalk port, and a SCSI port to let you attach an external hard disk for storing additional fonts. The Seiko printer also includes a second SCSI port for connection to a computer.

In addition to the graphics standards of PostScript and Pantone simulation, these five thermal transfer printers also suggest that standards are emerging in connection and storage options.

A GROWTH CURVE

One other trend well worth noting is that the color printer market is both growing and shifting. One measure of that growth is the new players getting into the game. The NEC Colormate PS, for example, is NEC's first high-quality color printer.

More interesting is the way the market is segmented and how the importance of these segments is changing. BIS CAP International projects separate growth figures for each of three markets: engineering and scientific, graphic artist, and office. The last category will generally translate to desktop publishing and business presentation applications.

The engineering and scientific market is the most mature and shows the least growth (15,300 printers shipped in 1989, 17,300 expected in 1990, and 20,300 expected in 1993). The two other areas have been minor segments until recently. The graphic arts market is still relatively

THE CANON COLOR LASER COPIER 500: First of Its Kind

by Bill O'Brien

It may at first seem odd to find a copy machine in a *PC Magazine* printer article, but its inclusion indicates how the lines of technology are blurring. The $49,000 Canon Color Laser Copier 500 incorporates the latest in dry color reproduction techniques, and is comprised of two distinct components: a scanner and a printer, integrated to function as a copier. Combined with Canon's Intelligent Processing Unit (IPU) and powered by any of an assortment of third-party PC-based software, the CLC 500 becomes an incredible CMYK and RGB color graphics environment.

The $49,000 Canon Color Laser Copier 500

Performance specifications are impressive for a color copier: the engine is rated to process 5 copies per minute (cpm) during four-color operation or 6 cpm for three-color output on 8.5- by 11-inch paper. Ledger-size copies drop that rate to 3 cpm and the imaging area is the same as the paper size—less 8 millimeters on the leading edge and 2 mm. on the remaining sides.

The scanner includes the opticals needed to read in the image and also contains a digitizing tablet and stylus built into the top cover. The stylus, the small control console recessed under a sliding panel, and the 2- by 4-inch LCD touch-sensitive screen indicate that the CLC 500 is more than just another color copier.

To extend the CLC 500 to the realm of PCs, you'll need to add the $10,500 IPU, which is essentially a host interface that provides communication back and forth between the copier and your PC via a GPIB-488 connection. More than that, the IPU also becomes the holding area for in-process graphics. Sufficient memory, however, typically means endowing the IPU with its maximum of four 6MB memory boards—a total of $33,000 in all.

You'll pay between $1,000 and $15,000 for the privilege of manipulating sophisticated graphic images on your PC. At the very heart of all the software is the ability to duplicate the CLC 500's control panel functions from your computer; but, things go further than that.

Texnai/Laser Today's *FBX Studio Set/AT* ($12,500) is a windowing program that works with bitmapped IPU images in small segments. You have complete maneuverability to reach, modify, and enhance every pixel, but you lose the large picture view until you print it. *Wasatch's Portfolio* ($8,495), aimed more at the graphic designer than the graphic artist, uses a combination of vector and raster techniques to simulate the huge bitmapped image. There is a small degradation in visual quality on screen, but the integrity of the image is maintained when printed. Alternately, *Freedom of the Press* ($2,990) from Custom Applications Inc. translates PostScript images into Canon-compatible color output. The finished product is extremely well done and the driver they designed specifically for the CLC 500 is a $1,495 component of the package price. Further down the low-end, Digistat has *Connection 500* ($2,000) to help integrate desktop publishing with the CLC 500.

The sophistication of the CLC 500 requires a stable environment with low humidity. It also needs a dedicated, regulated AC line because line voltage fluctuations can cause variations in color output. Because the CLC 500 is nearly 90 percent electronic and 100 percent new, service may not be what you expect for an $83,050 piece of equipment. The technicians themselves are still in learning mode and you may be forced into a few concessions, especially if you expect a 1:1 color correspondence between the original and the copy. Physically, it's simply not possible given the variety of color mixing systems in use. Even if you acquiesce to a best-effort result, it may take several service calls to Canon before the machine finally settles down to even that level of performance.

At its price level, the best application, of course, would be to assign the CLC 500 as a network resource. But, if you've ever stood in line waiting to make a copy, you'll begin to appreciate the potential nightmare of a shared network device where the original is removable from the scanner.

Even with all of that, the Canon Color Laser Copier 500 presents such a new level of graphics facility that it can easily let one person do the work of three. And the output, despite small variations in hue for some color assignments, is unanimously applauded. The CLC 500 may not be the next graphics printer you purchase, but it will certainly be its progenitor. ■

Canon Color Laser Copier 500
Canon USA Inc., One Canon Plaza, Lake Success, NY 11042; (516) 488-6700. **List Price:** $49,000 (base); $83,050 (tested configuration); Intelligent Processing Unit, $10,500; Intelligent Processing Unit with 24MB RAM, $33,000. **Standard Warranty:** Service contract with local dealer. **Dimensions (HWD):** 36.5 x 29.3 x x 37.3 in. **Weight:** 602 lbs.

CIRCLE 674 ON READER SERVICE CARD

EDITORS' CHOICE

•Take Your Pick

It's not often that every product in a category is so closely matched that we can wholeheartedly recommend each one. But if you're looking for high-quality, 300-dpi, vibrant color output, then any of these color thermal transfer printers—from NEC, QMS, Océ Graphics, or Tektronix—will do the job splendidly. So splendidly, in fact, that we can't give any of them an Editors' Choice award over the others.

Significantly, the Editors' Choice winner from our last overview (see "Color Page Printers: Affordable at Last," November 14, 1989) is also one of this year's contenders. The QMS ColorScript 100 Model 10 is back in a beefed-up version, with more memory at a lower price. However, where the Model 10 once stood out for its price-performance ratio, it seems that now everyone else has caught up.

All of these printers produce brilliant colors, and they all share the same set of key features: Pantone-certified simulations, a SCSI port for an external hard disk, parallel, serial, and AppleTalk ports for connection to computers, and some form of PostScript. The match is so even that you can't go far wrong with any of the choices. Still, each one has something in particular to recommend it.

Tektronix offers the lowest list price, at $7,995. And although the company's own version of PostScript may give pause to those who want a printer for proofs rather than final output, the printer breezed through our compatibility tests without problems. The maximum image size is marginally the smallest of any of the printers reviewed, but at 8.2 by 10.9 inches on legal-size paper, it will still nearly fill a letter-size area. And the HPGL emulation is a valuable extra for programs that don't speak PostScript.

If you insist on true Adobe PostScript—possibly because you can't risk the slightest chance of not having an exact match between the output from your printer and some other device—then take your pick from any of the Adobe PostScript printers reviewed: the NEC Colormate PS, the Océ Graphics OcéColor, or the QMS ColorScript 100 Model 10. Not only do all three match each other for color quality, Pantone simulation, and connection options, but all have essentially the same list price—at $8,990 for the Océ Graphics printer and $8,995 for the NEC and QMS printers.

Differences among these three are minor. The QMS Model 10 is the only one that offers an HPGL emulation, and it prints a maximum image size of 8.1 by 12 inches on legal size paper. The OcéColor has a maximum image of 8.2 by 11 inches on its special letter+ paper (8.5 by 12.7 inches). The NEC Colormate PS is notable for its ease of use. As tested, it didn't support printing on legal-size paper, but NEC says the feature will be added by the time you read this, with a maximum image of 8.1 by 12 inches. For most purposes, the three printers are completely equivalent, and you can safely choose any one of them over the others based strictly on which one you can find at the lowest street price.

If you're looking to print proofs rather than a finished product, be forewarned that none of these printers yields a complete set of true Pantone colors. However, that's a limitation inherent in the physics of the four-color printing process itself, not a flaw in the printers. (The Pantone Matching System uses eleven inks, not four.) Also, if you need to print on B-size paper, you'll want to look at the QMS ColorScript 100 Model 30 that won an honorable mention in our last color page printer roundup (see "Color Page Printers: Affordable at Last," November 24, 1989).

Finally, the Seiko ColorPoint PS 4 deserves some kudos as well. Even though the unit we looked at still had some pre-production glitches, the printer is very much in the same league as the other four. It too offers brilliant colors, Pantone simulation, a SCSI connector for an external hard disk, and parallel, serial, and AppleTalk ports. It also offers a second SCSI port, for connection to a computer. Because it uses roll paper instead of cut sheets, it can print almost to the edge of the paper, yielding a maximum image size of 8.5 by 13 inches on Seiko's super A-size paper. The PhoenixPage version of PostScript rules out the PS 4 if you insist on true Adobe PostScript, but it easily passed all of the compatibility tests we put it through. With a list price of $6,999, the PS 4 promises to be a good value indeed.

small but growing rapidly (2,500 shipped in 1989, 4,200 expected to ship in 1990, and 8,000 in 1993). The office market is far larger and growing faster than either of the other segments (9,400 shipped in 1989, 13,900 expected to have shipped in 1990, and most significantly, 22,400 by 1993).

So, by BIS CAP International's projections, business buyers of color PostScript printers will outstrip engineering and scientific purchasers and almost triple graphics acquisitions by 1993.

Color printers are shifting from being a niche product to being a mainstream business tool—for desktop publishing and for high-quality color presentations. Not surprisingly, printer manufacturers are shifting *their* focus as well—to issues that are most important to the business user. One of the more interesting of these, though it's not addressed in the current crop of printers, is matching colors between monitor and printer. As high-quality color printers move increasingly into the office, color matching will become more important.

COLOR MATCHING

The idea behind color matching is simple enough: extend the concept of WYSIWYG to color as well as the shape and formatting of a page. But as David Tait, Product Marketing Manager at Tektronix, points

out, color matching is only important for a certain class of users. Tait suggests that most engineering and scientific users, as well as some business users, are satisfied simply to have clearly distinguishable colors on both screen and printout. Graphic artists, in contrast, care very much about getting precise colors, but they already know how to make the translations between what they see and what they expect to get.

Tait says, and most observers agree, that even graphic artists would appreciate WYSIWYG colors as a way to avoid unpleasant surprises for clients. But the lack of color matching is a problem primarily for the business user, who is typically unsophisticated in the art and physics of color.

Unfortunately, there are some fundamental technical problems involved in color matching. For example, we perceive colors differently depending on the background. So even if a screen color and printed color match exactly, they will still appear different, since the white background on the screen won't match the white background of the paper.

Similarly, we perceive colors differently under different lighting conditions. A particularly sticky issue is that color samples produced with different technologies may match under one lighting condition—such as daylight—but be obviously different under others—such as fluorescent lights. That's why graphic artists generally view proofs under specific standard lighting conditions.

Another key problem is that each color device—including each monitor and printer—has a specific set of colors it can produce. This set of colors, called the color gamut, varies with several factors. One of the most important is the set of base colors the device uses to create other colors.

For example, monitors use the RGB color model, so called because it creates colors by varying the levels of red, green, and blue on the screen. Printers generally use either the CMY (cyan, magenta, yellow) or the related CMYK (cyan, magenta, yellow, black) model. Since the RGB and CMYK models each start with a different group of base colors, it's not surprising that the color gamuts for monitors and printers differ significantly, though there is substantial overlap.

Even within a given color model, the color gamut will vary depending on the specific colors in any given device. As already mentioned, each of the printers reviewed here uses slightly different versions of the base colors. As a result, each one has a different color gamut, even though all of them create colors with the CMYK model. In general, two printers of the same model will have a closely matched color gamut, since both will use the same base colors and same process for putting the ink on paper.

Consistent color gamuts are far more problematic for monitors than for printers. Not only do different manufacturers use different phosphors, but even two monitors from the same production line may differ because of slight variations in phosphor thickness or other normal manufacturing deviations. And the color gamut for any specific monitor will change as the phosphor ages.

What's more, a given set of RGB signal levels sent to a given monitor will produce different colors depending on the setting for the brightness and contrast controls. And, the same set of signals will yield one color when the monitor is just turned on, and another when it's warmed up. As with printed material, the perceived colors will even change depending on lighting conditions.

Given the relative predictability of printer colors compared to screen colors, it's ironic that most people will blame the printer when printed colors don't match the screen. But as Dale Richmond, Director of Marketing at Seiko points out, that's exactly what happens. A secretary or executive will carefully adjust the screen colors to taste, print the graphic, and then blame the printer for not producing a match. Since it's perceived that the printer is at fault, at least some printer manufacturers feel it's their job to address the issue.

Any color matching system has to at least do three things: First, it needs a way to calibrate the monitor, so the system can create a database that matches specific RGB signal levels to specific colors. Second, it needs a database of printer colors that matches specific CMY or CMYK values to specific colors. And third, it needs a completely objective, device-independent way to describe colors in the first place, so the system has a common language of "specific colors" to translate from RGB value to color description to the CMY or CMYK value for the printer.

Fortunately, it's not difficult to find an unambiguous color model. The first was developed by the CIE (Commission Internationale de L'Eclairage or the International Commission on Illuminations) in 1931. It has since been updated, and now exists in several variations. Even better, the color description in any variation can be translated to another by straightforward mathematical formulas.

Creating a database of printer colors is reasonably simple. There is relatively little variation for individual printers, and manufacturers can easily supply a look-up table with each printer model.

Creating a database of printer colors is also reasonably simple. As already mentioned, there is relatively little variation for individual printers. Manufacturers can easily supply a look-up table with each printer model, in much the same spirit as a device driver.

In fact, the trickiest part in all this is calibrating the monitor. There is currently no practical way to do that in the DOS world, though there are a few appropriate tools for the Macintosh. The basic approach is to attach a color sensor to the screen, typically by suction cup, and let the package run through a set of RGB values, read the colors off the screen, and make compensating adjustments to the video card.

Given a way to describe colors objectively, a look-up table for your printer, and the ability to calibrate a monitor, all that remains is to write software that will handle the translation. Ideally, the software should also show you the color gamuts of your printer and monitor, so

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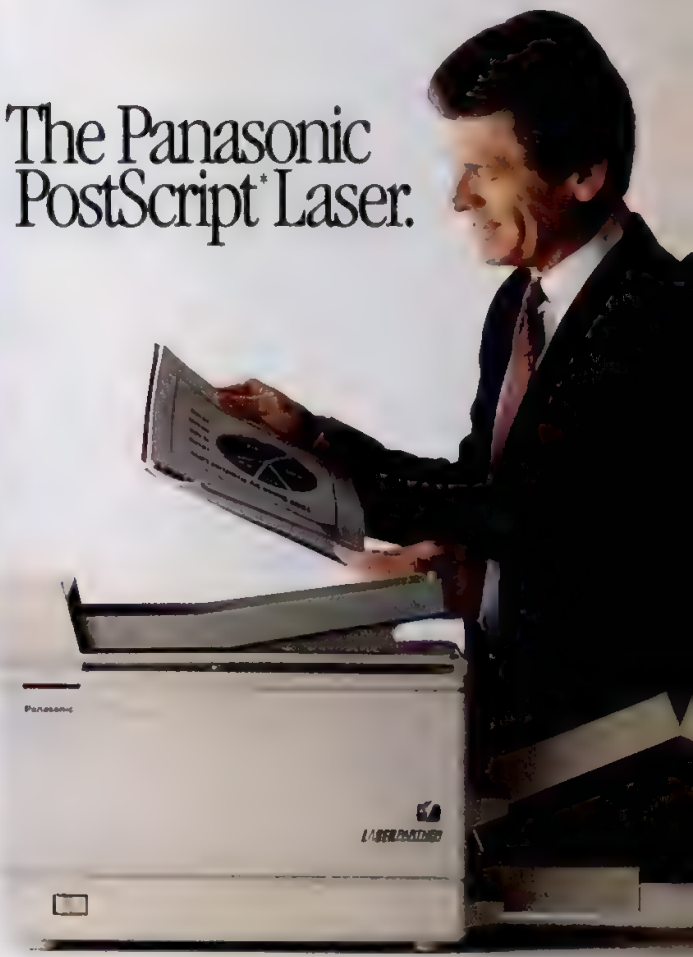

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Compatibility: HP LaserJet Series II emulation.*
Fonts: 22 Internal Fonts-11 available in both portrait and landscape. Two slots for optional font cards.
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Resolution: 300 Dots Per Inch.
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you can compare the two, and know when you're looking at a color on-screen that your printer simply cannot produce.

As of this writing, at least one complete color matching package—with screen calibration, printer look-up table, and software—has been announced for the Macintosh by SuperMac Technology, and we should be seeing similar packages for DOS before too long. However, as Jim Forrest, Senior Marketing Manager at NEC points out, color for the Macintosh is two to three years ahead of color for DOS. Part of the problem is that there are more video standards in the DOS world to help complicate the issue. And, there is no single color picker accessible to all DOS programs the way there is with the Mac. *Windows* 3.0 may help change that.

One important step towards eventual color matching of screens with printers is Adobe's announced PostScript Level 2. Among other things, Level 2 will incorporate device-independent color description as part of PostScript. According to Adobe, we should be seeing the first Level 2 printers somewhere between spring 1991 and spring 1992.

Another notable development is that Tektronix has developed, and is actively lobbying for, its own color matching system called TekColor. TekColor is an open system. Tektronix is not only willing to license it, but according to those who are discussing the issue with Tektronix, the company is asking reasonable licensing fees.

TekColor uses a color model developed by Tektronix. The model, called HVC, defines each color by its hue (the

HOW TO READ THE PRINTER GUIDE AND TABLES

For a quick look at the printers reviewed in this article, turn to the *PC Magazine* Printer Guide. In the Guide, you'll find the results of PC Labs' tests and a listing of each printer's most important features, its price, and samples of both text and graphics output.

Fonts & Features
Each printer is accompanied by a Fonts & Features table that shows you what features or enhancements are available with each font offered under one emulation.

We've shown what features are available with four common fonts—Helvetica, Times, Courier, and Line Printer—in four different point sizes—8/9, 10, 12, and 14. Since some printers let you choose a font in any size you want, we've also included a Scalable category. Please note that for some printers, what we call a feature (the bold enhancement to the Courier font, for example) is actually a separate font—called *Courier Bold* in HP-ese.

For samples of some of the fonts and features for each printer, see the text output in the *PC Magazine* Printer Guide.

FONTS & FEATURES
NEC Colormate PS

PostScript	Helvetica				Times				Courier				Line Printer			
	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold
8/9-point																
10-point																
12-point																
14-point																
Scalable																

Text Speed
Rather than relying on the rated speed supplied by each printer manufacturer, PC Labs timed each printer's text output speed. The reported text speed tells you the rate in pages per minute (ppm) at which each model printed out ten copies of our Arthur D. Author test—a two-page, single-spaced business letter. See the 3-D bar chart in each section for relative printer speeds.

Color Output
For these color-capable printers, we've included the results of our color test. To see how each printer handles color, take a look at how it prints the six colors in our test: blue, red, magenta, green, cyan, and yellow.

Text Quality
To see how the text output from each of our printers compares, read the quote from Leo Tolstoy that offers a sample of fonts and features. And for a list of which features are available with fonts under certain emulations, see the Fonts & Features table accompanying each review.

NEC Colormate PS — $8,995

300-dpi, PostScript-compatible, color thermal transfer printer

TEXT SPEED: 2.8 ppm
GRAPHICS SPEED: 0.54 gppm
GRAPHICS TIME: 1 min. 49 sec.

Man's mind cannot grasp t
of events in their complete
but the desire to find the c
is implanted in man's soul.
Courier **Bold** Under

Graphics Speed
Our graphics output test doubles as our graphics speed test. In addition to reporting the actual time each printer took to output the scanned photo, we've converted that time to a rate we've named graphics pages per minute (gppm). For a quick comparison of speeds, turn to the 3-D bar chart.

Graphics Time
To find out how long you'll have to wait for each of our printers to output a typical graphic image, take a look at how long it took to print our scanned photo, reported here in minutes and seconds.

Graphics Output: Scanned Half-tone Image
At PC Labs, we tested each printer's ability to handle graphics output with this scanned photo, which was taken specifically for the test and contains many shades of gray. We've included it to make it easy for you to compare the printers' half-tone output.

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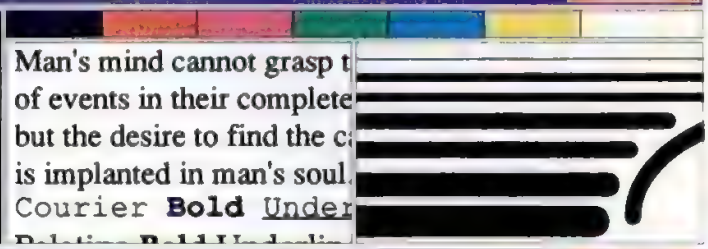
IT'S ALL BUSINESS.

System Requirements: IBM® PC, XT, AT, PS/2® or compatible; DOS 2.1 or higher; 512K RAM and hard disk.

NEC Colormate PS

300-dpi, PostScript-compatible, color thermal transfer printer

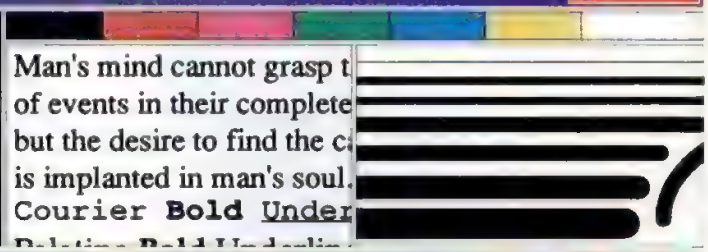
TEXT SPEED: 2.8 ppm
GRAPHICS SPEED: 0.54 gppm
GRAPHICS TIME: 1 min. 49 sec.



OcéColor

300-dpi, PostScript-compatible, Pantone-certified, color thermal transfer printer

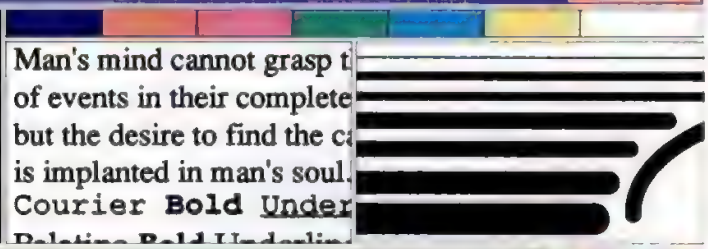
TEXT SPEED: 1.3 ppm
GRAPHICS SPEED: 0.6 gppm
GRAPHICS TIME: 1 min. 36 sec.



QMS ColorScript 100 Model 10

300-dpi, PostScript-compatible, Pantone-certified, color thermal transfer printer

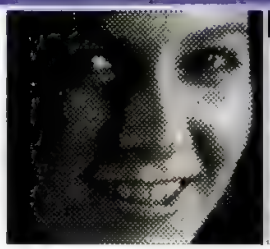
TEXT SPEED. 2.9 ppm
GRAPHICS SPEED 0.6 gppm
GRAPHICS TIME. 1 min. 39 sec.

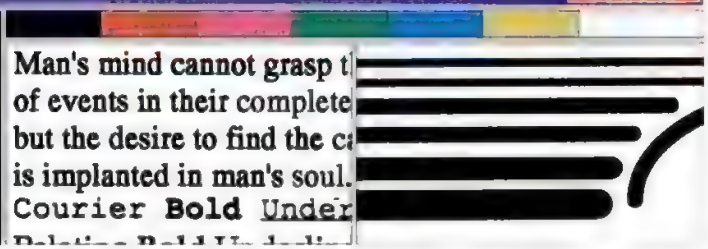


Tektronix Phaser PX

300-dpi, PostScript emulating, Pantone-certified, color thermal transfer printer

TEXT SPEED: 1.3 ppm
GRAPHICS SPEED: 0.3 gppm
GRAPHICS TIME: 3 min. 25 sec.





color family, such as blue or green), value (the variation between light and dark), and chroma (the degree of saturation or vibrancy of the color). This HVC model is a variation on the CIE models and according to Tektronix, dovetails nicely with PostScript Level 2.

Significantly, QMS, NEC, Seiko, and Océ Graphics are all committed to supporting PostScript Level 2, and all are at least tracking TekColor closely as a future possibility. However, NEC's Forrest, for example, worries that TekColor's current implementation may be too limited to deal with the full range of monitors and printers on the market. Not surprisingly, there is also a bit of resistance to the TekColor name from companies that are, after all, in competition with Tektronix.

PICKING A PRINTER NOW

Whatever the future of color matching, the reality is that it's not here yet—at least not in the DOS world. And for the moment, the question is how to choose a printer from those that exist right now. With such uniformly gorgeous output, picking a printer won't be easy, unless you need some special feature, such as the HPGL emulation that's only available in the QMS and Tektronix printers. However, here are some issues you'll want to consider when making your choice.

One obvious question is whether you need true Adobe PostScript. If you plan to produce boardroom-level graphics, presentation graphics, or other material where the printed output will be your final product, any of these printers will do the job. However, if you're looking to produce proofs for something that will be printed in final form elsewhere, you may want to be more conservative, and stay with Adobe PostScript.

Be aware that text spacing, in particular, may vary between Adobe PostScript and some other PostScript emulator. So if you hand a file to a print shop, for example, you may find that lines break at a different spot on your proof and on the final product. Only the NEC, QMS, and Océ Color printers offer Adobe PostScript.

Another basic issue is paper size. If you need a printer that handles B-size paper, you can immediately narrow your search down to the QMS ColorScript Model 30 (reviewed in the 1989 printer issue), the newly announced Model 30i

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★ CorelDRAW! 1.2

(Corel Systems)
CorelDRAW 1.2 is fun and easy to use. Fit text to a curve, kern letters on screen, rotate, stretch, skew, copy and combine. Over 100 typefaces and over 300 clip art images, free! Now a new program called CorelTRACE is bundled in at no extra cost. Converts bitmap images into vector graphics and handles large TIFF files without additional memory. **$315.**

★ YourWay

(Prisma Software, Corp.)
YourWay represents a major breakthrough in personal productivity software. This graphically oriented workstation is specifically designed to manage your personal information, activities and personal communications. Not a collection of tools, but a totally integrated system. Features include: Customized card formats, Calendar and To-Do Clipboards, word processing and a speller/thesaurus. **$113.**

★ Ami 1.2

(Samna)
Ami 1.2 is an easy, yet powerful word processor that will allow you to create professional looking documents using desktop publishing features. Use Ami's style sheets and WYSIWYG displays to create beautiful memos, reports or multi-column newsletters. Mix different fonts, insert graphics and use ruling lines and boxes. Winner of PC Magazine's "Editor's Choice." **$125.**

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(Softview)
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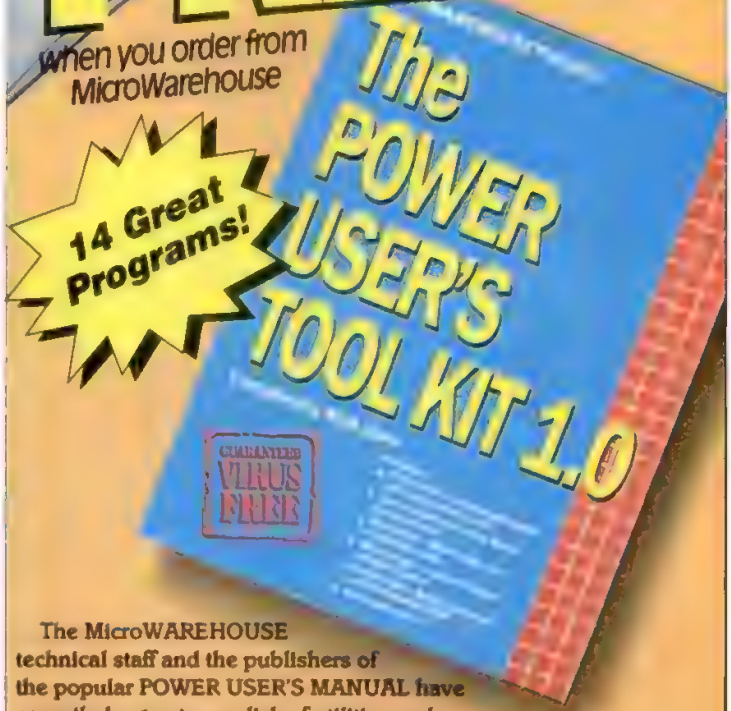

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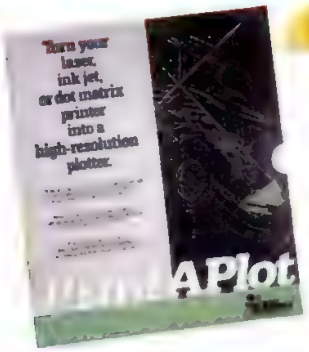

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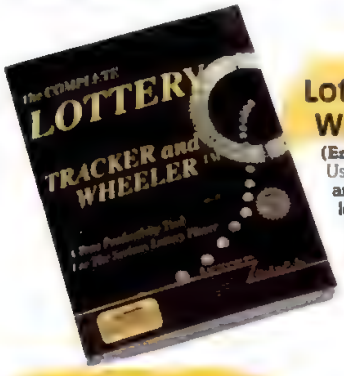

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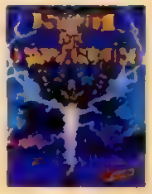

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CIRCLE 225 ON READER SERVICE CARD

(QMS says it's essentially identical to the Model 30), and possibly the Seiko ColorPoint PS 14. Although PC Labs hasn't tested the PS 14, Seiko says it's basically a wide carriage version of the PS 4 that we look at here in its pre-production version (see sidebar "The Seiko ColorPoint PS 4: Still in the Wings," for more information).

You'll also want to consider the maximum image size, as a separate issue from the paper (or transparency) size. The nature of color printing, with the need for a separate print pass for each color, puts a high premium on registration, so that each color is printed in exactly the right place. The only way to get that registration is for the printer mechanism to hold tightly onto the paper—a procedure that creates relatively large margins for machines that use cut sheets.

The NEC, QMS, Tektronix, and Océ Graphics printers can all produce an image that nearly fills a letter-size page, but only when using larger paper. For letter size output, the image sizes for all these printers hover around 8 by 9 inches. The actual numbers are: 8 by 9 inches for the Colormate PS, 8.1 by 8.5 inches for the Phaser PX, 8.1 by 9 for the ColorScript 100 Model 10, and 8.2 by 9.3 for the OcéColor.

All four printers will also let you get larger images on larger paper. The maximum sizes vary significantly, with the Phaser PX offering the smallest maximum image size, at 8.1 by 10.8 inches on legal-size paper. Next in size is the OcéColor, with a maximum image of 8.2 by 11 inches, then the ColorScript 100 Model 10, with a maximum 8.1 by 12 inches. As tested, the NEC printer did not support legal-size paper, but according to NEC, by the time this article is published, the firmware will be upgraded to allow 8.1- by 12-inch images.

If it's important to get the largest possible image size, you'll want to take a careful look at the Seiko ColorPoint PS 4. The PS 4 uses roll paper instead of cut sheets. This lets it hold the paper by a special printing margin, then cut off the excess margin when it's done. The maximum image for the Seiko printer on letter-size paper is an impressive 8.2 by 10.7 inches. The maximum image on Seiko's super-A size paper is a whopping 8.5 by 13 inches.

Finally, in looking over the reviews, you'll see some noticeable differences in graphics speed, ranging from 0.3 gppm to 0.6 gppm. Since speed is of no dire consequence to a color page printer, these differences aren't important enough to be primary factors in picking one printer over another. However, once you've narrowed the field down to one or two possibilities, you may well want to consider speed, along with price, as final differentiating factors. Also, we've included text speed because it's part of the standard battery of tests we run on any printer. Even though text speed is relatively unimportant in the color world, these numbers can still help you compare these printers across product categories or merely serve as another deciding factor in your selection process. In any case, whatever your needs for high-quality color printing, you can't go far wrong with any of these machines.

THE SEIKO COLORPOINT PS 4: Still in the Wings

By M. David Stone

At the last possible moment, Seiko Instruments Inc. sent us the newly announced ColorPoint PS Model 4. Almost too late for our regular deadline, the printer turned out to be a pre-production unit, which we ordinarily wouldn't cover, even though it only lacked a final ROM upgrade. However, after seeing the brilliant colors and 300-dpi output from this PostScript-compatible printer along with some unique capabilities beyond even some of its higher-priced competition, we felt that it deserved more than passing mention—especially given the $6,999 price, about $1,000 lower than the next least-expensive choice.

Built around Seiko's own CH5500-series thermal transfer engine, the PS 4 offers PostScript-compatibility by way of PhoenixPage, from Phoenix Technologies. The Phoenix version of PostScript seems to work well enough: The printer sailed through the PC Labs compatibility test without complaint. As you would expect, the 35 built-in Bitstream fonts match the usual Adobe PostScript offerings. According to Seiko, the printer will accept Type 1 and Type 3 fonts as well.

The Seiko engine is rated at about 1 ppm with the three-color ink sheet and tested only a little slower for text speed, at 0.86 ppm. On the more-significant graphics speed test, the PS 4 managed 0.35 gppm. Although that's only half the speed of some other printers in this category, it's still within an acceptable range.

More important than speed is the color quality, which is brilliant. As is typical of three-color printing, black and white images have a sepia tinge, except where the black is solidly filled in. Text is well formed and suitably black, making it acceptable for labels on a color image. If your output includes gray shades, however, you'll want to use the four-color ink sheet, with its added black ink. The production model will also include Pantone-licensed software with printer-specific recipes for three- and four-color Pantone simulations.

The $6,999 Seiko ColorPoint PS 4 can produce large, brilliant output with its roll-paper technology.

Prices for the ink sheets are $70 for a 176-image, three-color roll and $62 for

NEC Technologies Inc.

NEC Colormate PS

by Alfred Poor

NEC Technologies has entered the color page printer market with a new PostScript printer that carries the same $8,995 list price as its close competitor, the QMS ColorScript 100 Model 10. The new NEC machine is equivalent to the QMS printer in many other ways as well.

The Colormate PS is built around a NEC print engine that uses thermal transfer technology with 300-dpi resolution. You can get black, three-color or four-color ink rolls, with per-page costs that are typical for the class: $0.18 for black, $0.42 for three-color, and $0.60 for four-color. You'll find the ink rolls are extremely easy to install, and changing ribbons is a snap, especially since the Colormate PS automatically senses which ribbon has been installed.

The controller comes with 8MB of memory as standard. The true Adobe PostScript includes the full complement of 35 scalable font outlines. The printer was able to print text at a 2.8-page-per-minute (ppm) rate with the black ribbon, and produce our graphics image in 0.5 graphics pages per minute (gppm), just slightly slower than the QMS times. The Colormate PS offers a complete range of connectors—parallel, serial, and AppleTalk—as well as a SCSI port for an optional hard disk that you can use to store downloaded fonts and images.

While you can use plain paper in the printer, you'll want to use special paper for best results. The print samples were crisp and vivid. NEC does not claim Pantone certification for its color output, but instead chooses to say that it can simulate the colors when using a Pantone-certified application program. We printed sample Pantone colors and found that while the Colormate PS output was close, there were some obvious differences when the printer produced lighter shades.

The printer is a cinch to setup. The interface is selected using the buttons on the simple front panel, and your choices are guided by a 16-character LCD display. There are no DIP switches, and aside from plugging in the power and interface cables in the back, you can setup and run the printer conveniently from the front. Even the power switch is conveniently located on the side of the unit, where it can be reached without any difficulty.

Paper is loaded in a vertical bin that can hold up to 80 sheets of paper at a time. The Colormate PS cannot take legal-size sheets; it accepts only letter- or A4-size pages. The output arrives

FONTS & FEATURES

NEC Colormate PS

PostScript

	Helvetica				Times				Courier				Line Printer			
	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold
8/9-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
12-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
14-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Scalable	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

a 123-image, four-color roll. The price per image works out to about 40 cents for the three-color roll, and about 50 cents for the four color. A $70 monochrome ribbon yields 600 images, at 11.7 cents per image.

The Seiko engine is notable for using roll paper. This gives it plenty of extra paper to hold onto, without needing large top and bottom margins on the final product. When the printer finishes the last pass, it cuts off the excess top margin, then cuts the page off the roll. The end result of this feature is a larger image area than with most printers in this category.

The paper rolls come in three widths, yielding letter-, A4-, or A Super-size (8.8 by 15-inch) formats. The claimed maximum image size is 8.5 by 13 inches for the A Super format. The image on letter-size paper, as measured on PC Labs' edge to edge test, is a remarkably large 8.2 by 10.7 inches. Transparency rolls come in letter and A4 sizes only. It's also worth noting that Seiko has announced a $9,999 ColorPoint PS 14, which is essentially a wide-carriage version of the PS 4 able to print on B-size (11- by 17-inch) paper. This presents some wonderful presentation spreadsheet and graphics possibilities.

Like other printers in this category, the ColorPoint PS 4 has multiple connectors—for parallel, serial, SCSI, and AppleTalk connections. All are active simultaneously, so you can plug in a PC and a Mac, for example, and print from either one without having to change settings. The printer also has a second SCSI connector to allow room for a hard disk to store additional fonts. However, Seiko does not currently sell a drive. The only options are for memory upgrades above the standard 6MB—at prices from $1,000 for a 4MB upgrade to $8,200 for 28MB. Maximum RAM is a remarkable 34MB.

Setup is straightforward. Aside from plugging in the cable, or cables, you only have to load the ink sheet and paper roll, a procedure that's clearly explained in the manual. The 22 buttons on the front panel look daunting, but if you need to change settings, the 16-character LCD gives understandable responses. The manual also clearly explains the menus.

The pre-production ROM was missing some features, including the ability to print test images. Also, the printer crashed occasionally, forcing us to turn it off and on to get it working again. When we called Seiko, the company traced the crashes to a faulty ROM burner, rather than any inherent problem in the firmware itself.

All told, the ColorPoint PS 4 promises to be a better-than-average value. The only problems that showed up on PC Labs' tests are the sort of glitches that you would expect to encounter in a pre-production unit. The bottom line here: At $6,999 the ColorPoint PS 4 brings PostScript-compatible, thermal transfer color printing to an even more affordable price. ■

Seiko ColorPoint PS 4

Seiko Instruments Inc., 1130 Ringwood Court, San Jose, CA 95131; (800) 873-4561, (408) 922-5800. **List Price:** $6,999; upgrade to 10MB RAM, $1,000; upgrade to 34MB RAM $8,200. **Standard Warranty:** 90 days on-site. **Dimensions (HWD):** 8 x 13.5 x 25.3 in. **Weight:** 41.8 lbs. **Emulations:** PostScript emulator.

CIRCLE 675 ON READER SERVICE CARD

PERFORMANCE TESTS: COLOR PAGE PRINTERS

Although speed isn't of primary importance when considering color page printers, PC Labs puts our four entries through their paces. Speeds are similar in text mode, though true Adobe PostScript seems to have a graphics speed advantage over PostScript emulators.

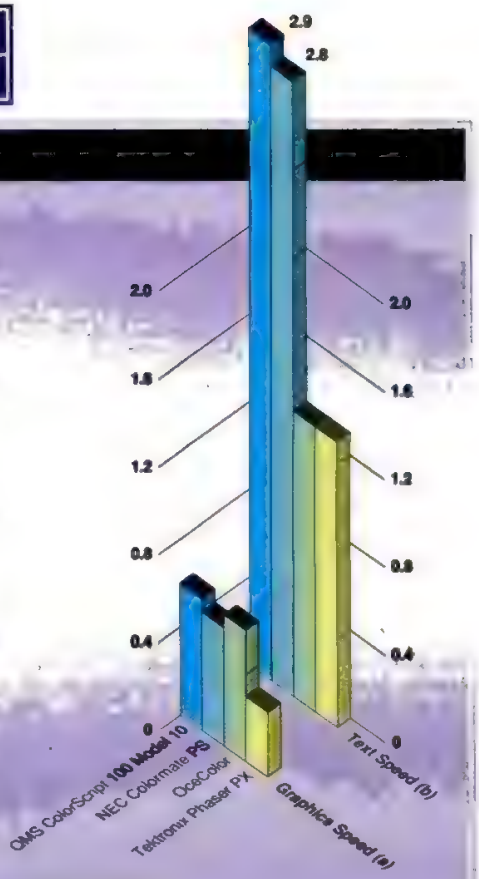
The **Graphics Speed** test measures the time needed to send and print two copies of a graphic image created using *Aldus PageMaker* and *Microsoft Windows*. Results are reported in graphics pages per minute.

The **Text Speed** test measures the time it takes to send and print ten copies of a two-page business letter of 10-point Courier type. The document has a 1-inch margin all around. The color printers' results are reported in pages per minute.

Speed is not the primary consideration when deciding among color page printers. Color fidelity, resolution, maximum printable area, and cost per page are all as–if not more–important than printing speed. Nonetheless, for those people doing short-run color print jobs for presentations or printing professionals needing color proofs as quickly as possible, speed does play a factor.

For this group of printers, however, there are no performance standouts one way or the other. The fastest text printers were the QMS ColorScript 100 Model 10 and the NEC Colormate PS. Both turned in times of 2.9 and 2.8 pages per minute, respectively, with the black ribbon installed. The OcéColor, for which there isn't a black ribbon available, ran at 1.3 ppm, typifying the speed of three-color process printing for true Adobe PostScript printers. Also using a three-color black ribbon, the Tektronix Phaser PX ran at 1.3 ppm.

While text performance was essentially identical for the four-color printers, graphics performance was slightly different between the true Adobe PostScript machines and the printer running a PostScript emulator. Both the QMS and the OcéColor output our 750K PostScript file at 0.6 graphics pages per minute. The NEC Colormate was just a tad slower, clocking in at 0.54 gppm. The Tektronix, using its own proprietary PostScript emulator, ran at half the speed of the true-Adobe printers, turning in a time of 0.3 gppm. This could be due to either the engine speed or the non-Adobe emulator–or both. Unfortunately, our tests were unable to isolate the cause.



(a) graphics pages per minute (b) pages per minute

faceup in another vertical tray, and NEC provides a "privacy cover" that keeps your pages covered and hidden from the more curious eyes in the office.

The Colormate PS is going to make the color PostScript page printer market more interesting than it's ever been. Given the fact that many NEC products are heavily discounted on the street, this printer may well produce strong pressure to lower prices in this class. The Colormate PS is missing some of the features found on its QMS competition, but most users will find it equally well suited for most tasks—clearly a strong contender for the top spot in affordable color output.

FACT FILE

NEC Colormate PS
NEC Technologies Inc., 1414 Mass. Ave., Boxborough, MA 01719; (800) 632-4636, (508) 264-8000.
List Price: $8,995; 20MB SCSI hard disk, $995.
Standard Warranty: One year parts and labor, 90 days on-site.
Dimensions (HWD): 15.3 x 17 x 21.5 in.
Weight: 55 lbs.
Emulations: PostScript.
In Short: The NEC Colormate PS helps make color PostScript printing affordable. Offering advantages in ease of use and consumables handling, it's a good choice for color output.

CIRCLE 870 ON READER SERVICE CARD

Océ Graphics USA Inc.

OcéColor

by Bill O'Brien

Océ Graphics could remake an old saying into: "If you can join 'em, beat 'em too." Originally released at $10,990, Océ significantly dropped the list price on its OcéColor PostScript thermal transfer printer to $8,990—a move that brought the company's guns to bear on QMS' similarly priced ColorScript 100.

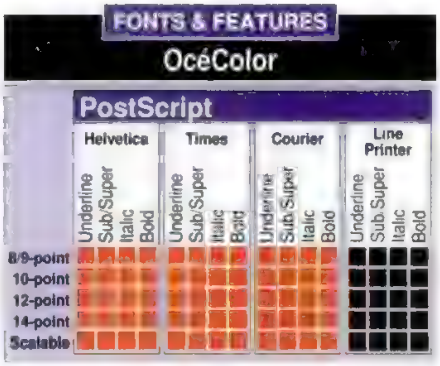
Ignore the sculptured contours of the OcéColor's case and you'll find that the printer occupies a 16- by 17.5-inch (WD) patch of desktop real estate. You'll need an additional 6 inches to account for the length of the installed 100-page paper tray and air rights cover 10 inches from the ground up. OcéColor uses one of the most stylized cases ever to arrive at PC Labs. A curved hood fills out the machine's top rear two thirds; this structure is not just for show because it houses the supply and take-up rolls for the OcéColor's wax transfer ribbon.

There is function to the rest of this case as well. At the rear, connectors are provided for parallel, serial, and AppleTalk interfaces. A one-line, 16-character LCD display prints error messages as well as the list of hierarchical menu options that cover the printer's functions, including interface type and manual versus cassette feed. And, unlike the stark LED panels of many PostScript color printers, all of the OcéColor's functions are programmable from the outside via its eight control buttons.

Deeper into the printer you'll find a 300-dpi 5 ppm laser engine powered by a 68020 processor running at 16.8 MHz and rated at a remarkable 120,000-page life. PostScript version 50.3 was resident in the reviewed machine's 1MB of ROM and 5MB of RAM was used to handle the

programming chores, imaging, and any downloaded fonts (Adobe Type 1 compatible). You have the option of expanding the OcéColor's memory to 8MB if your imaging chores are immense enough to require it.

Don't be fooled by the 5-ppm rating. Despite the full compliment of 35 Adobe outline typefaces, the OcéColor is not a text printer by any means. In fact, Océ Graphics doesn't even supply a black ribbon for the machine. If you decide that you must print text pages, you'll do so with process black, the result of several passes under a three- or four-color ribbon, and you'll do it at only 1.3 pages per minute according to PC Labs' text speed test. While this speed is relatively fast among color printers, it's slower than any low-end 4-ppm laser printer. With the three-color ribbon rated at 100 pages per roll and the four-color ribbon carrying an 80-page-per-roll limit, text printing also becomes expensive; you'll find it's more cost effective to add any $1,000 4-ppm laser printer for text chores.



If the OcéColor was designed to do graphics then the design was well done. Under the influence of PC Labs' graphic speed test it reached a respectable 0.6 gppm average speed for the two pages of graphic output. More so than speed, visual quality is important and here too the OcéColor is simply superb. Although there was some sepia tinting in the black and white gray scale, the bitmapped image contained only whites, grays, and blacks. The OcéColor's output also had a remarkable amount of detail for a 300-dpi print.

In the color wars between PMS, CMYK, and RGB standards, OcéColor has surrendered to the Pantone matching system used by offset printers. Given software that supports PMS color output, the OcéColor will give you reliable originals. Océ Graphics even includes a utility to print a PMS color chart with Pantone recipes.

The one possible fault one can find with the Océ Graphics printer is that it will not handle ledger-sized sheets. Instead, the normal 8.5- by 11-inch paper cassette doubles as a Letter+-size cassette that will fit special 8.5- by 12.7-inch sheets available from the company. Standard letter-size paper permits an 8.2- by 9.3-inch image area while the Letter+ size gives you enough room to successfully print an 11-inch long picture.

The manual accompanying the unit is well done, despite being evenly divided between the Macintosh and PC platforms. The printer produces excellent graphics, the colors are brilliant, and the price is at or below that of most competitive color printers. The OcéColor printer is as good as the genre gets.

OcéColor
Océ Graphics USA Inc., 385 Ravendale Dr., P.O. Box 7169, Mountain View, CA 94039-7169; (800) 545-5445, (415) 964-7900.
List Price: $8,990.
Standard Warranty: One year on parts and labor, depot repair with express parts service available.
Dimensions (HWD): 9.9 x 16.1 x 17.5.
Weight: 42 lbs.
Emulations: PostScript.
In Short: PostScript, good color, fast and accurate graphics, Pantone compatibility, and competitive pricing are as much as you could possibly want from a color printer. So is the OcéColor.

CIRCLE 671 ON READER SERVICE CARD

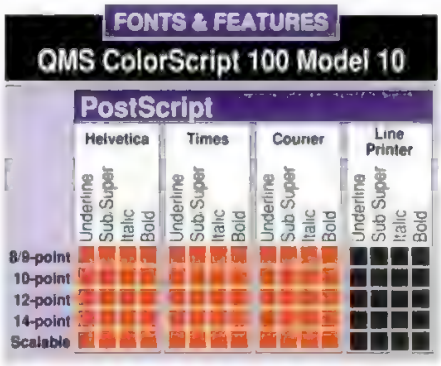
QMS Inc.

QMS ColorScript 100 Model 10

by Alfred Poor

In last year's Printer Project, the QMS ColorScript 100 Model 10 took home Editors' Choice honors, in large part because it provided true Adobe PostScript support in full color while breaking through the $10,000 price barrier. This year the printer is back with the same $8,995 list price, but also with a range of new features.

The most important change is a doubling of the installed memory for the printer, from 4MB to 8MB. This extra memory makes room for a larger font cache and more space for downloaded fonts. The extra RAM appears to give the printer a significant performance boost as well. Text speeds were only slightly faster, but on the more-important graphics speed test, this year's Model 10 was more than a third faster than last year: about 0.6 gppm to print our graphics image.



QMS has thrown in a few other goodies to sweeten the pot. The printer now comes with a free legal-size four-color ink roll, and four-color legal-size rolls have been reduced in price so the per-page cost is the same as for the letter-size rolls—$0.62 per page not including the paper. Rolls come two-to-the-pack, and you can get 85 pages from a letter-size roll, or 70 from a legal-size roll. You can get black-only rolls in either size (per page costs are better for the letter-size at $0.18 compared with $0.21 for the legal-size), or a three-color roll in the letter-size (which comes in at $0.53 per page.) You also need to use special paper for best results.

QMS has bundled an HPGL emulation with the printer that used to cost $199 as an option. This is a disk-based emulation that gets downloaded to the printer. We didn't test this feature, but it may be useful for printing charts from programs that offer plotter support but not PostScript.

QMS has also increased confidence in the 300-dpi thermal-transfer Mitsubishi

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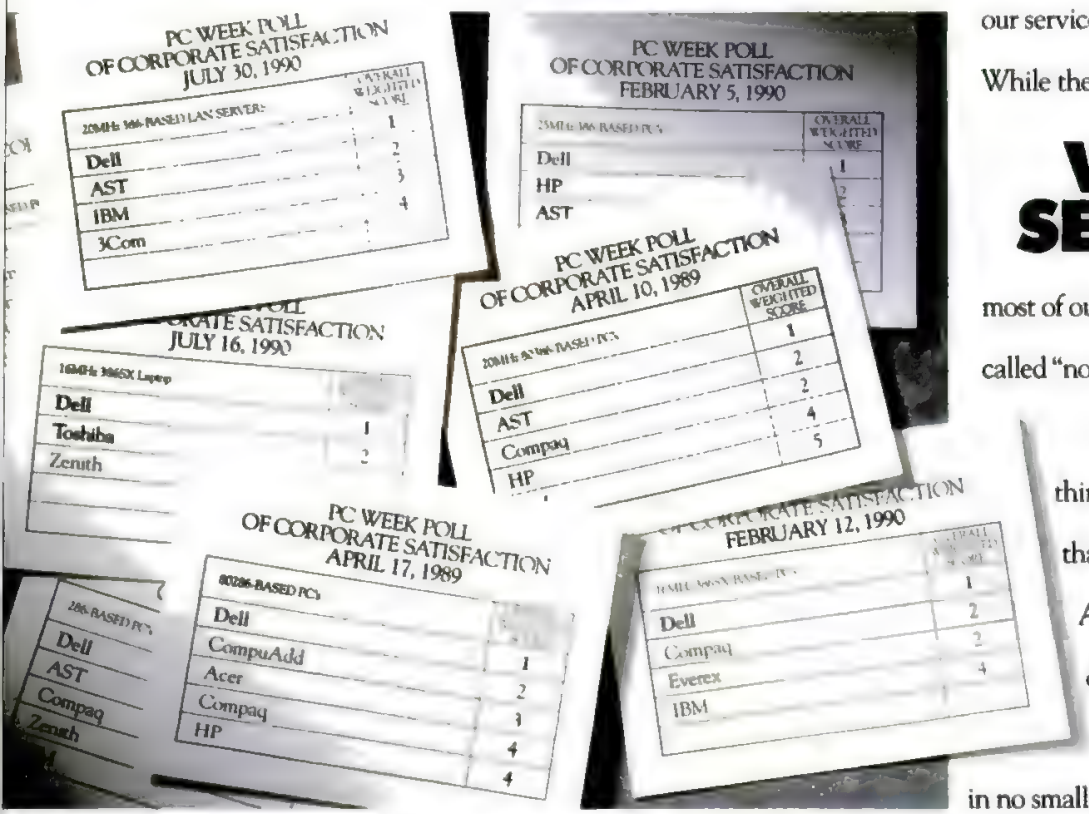

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FACT FILE

QMS ColorScript 100 Model 10
QMS Inc., One Magnum Pass, Mobile, AL 36618; (800) 631-2692, (205) 633-4300 ext. 1253.
List Price: $8,995; upgrade to 8MB RAM, $995.
Standard Warranty: One year on parts and labor
Dimensions (HWD): 11.4 x 16.8 x 24.2.
Weight: 57 lbs.
Emulations: PostScript, HPGL.
In Short: The ColorScript 100/10 is significantly improved over last year, with more memory and other standard features. The Pantone certification will matter for those who care, but most will want it simply for the brilliant colors and easy operation.

CIRCLE 672 ON READER SERVICE CARD

print engine. The rated duty cycle for the printer has been raised to 3,000 pages per month, up from 1,200. And the warranty has been increased by the company to a full year.

By and large, the printer maintains its other attractive features. It has parallel, serial, and AppleTalk interface ports. There is a SCSI port as well, which can be connected to an external hard disk as storage for downloaded fonts and images. There is a color separation switch which allows you to print black images of each of the four-color images that make up a printout; the four images can then be use to create printing plates for color printing processes. The printer is fairly easy to set up and get running, though installing and changing ribbons requires a few more steps than other designs.

Further, the printer is Pantone certified, and even comes with a utility that prints out 36 pages showing more than 700 Pantone colors. Most of the colors are created using dithered patterns, and while the matches are quite good for the darker shades, some of the Model 10 output appeared too dark or off-color compared with certain lighter Pantone colors. Still, the colors are quite true and the output should be useful as color proofs for all but the most discerning eyes.

QMS executives presumably decided that it was better to keep the printer's price stable, and increase value by adding features. Now that the under-$10,000 PostScript color-printer race is getting a bit more crowded, we already see competition bringing prices down. The ColorScript 100 Model 10 is much improved over last year's winning design, but there are newcomers already charging to knock it off the top of the hill.

Tektronix Inc.

Tektronix Phaser PX

by M. David Stone

Last year, the big news in color printers was the QMS ColorScript 100 Model 10, the first color PostScript printer under $10,000. This year, the price breakthrough is old hat, as demonstrated by the Phaser PX from Tektronix Inc. With a list price of only $7,995, the Phaser PX is not only Tektronix's lowest price PostScript-compatible color printer, it's getting dangerously close to being truly affordable.

Built around a custom engine manufactured by Sharp, the Phaser PX offers 300-dpi resolution, brilliant color output, and Tektronix's own color PostScript-compatible interpreter as well as an HPGL mode. As an added bonus, the printer is Pantone certified.

On PC Labs' tests, the printer was just a bit slower than its rated speed, with a text speed of 1.27 ppm with a three-color roll. As expected, graphics speed was far slower, coming in at 0.29 gppm. But, of course, as with any color graphics printer, the output quality is far more important than the speed.

As already indicated, the color output is nothing short of gorgeous, with brilliant color at 300-dpi resolution. This proved true for transparencies as well as for output on thermal transfer paper. The black and white graphics are notable for crisp, clean lines and solid areas filled in with an even black. The scanned-in photo retains all the requisite detail and shading on both thermal transfer paper and transparencies.

FONTS & FEATURES

Tektronix Phaser PX

PostScript

	Helvetica				Times				Courier				Line Printer			
	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold	Underline	Sub Super	Italic	Bold
8/9-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
10-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
12-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
14-point	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Scalable	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Text is generally in the same league as graphics, with only a few notable exceptions. On PC Labs' fonts and features test, for example, the Courier upper-case "C" consistently printed with a jagged notch, as did the lower-case "d." Interestingly, these problems seem confined to the Courier fonts. At least, they didn't show up in any of the other fonts we tested—including Times Roman, Helvetica, and Palintino.

The Tektronix version of PostScript is notable for printing out a status page on our test, unlike many PostScript clones. The printer comes with a full suite of 36 typefaces, and—according to Tektronix—can accept Type 1 and Type 3 downloadable fonts.

Setting up the Phaser PX is simple enough, thanks to a fold-out page entitled "Installing the Printer." The only tricky part is loading the enclosed three-color transfer roll. However, after installing it

FACT FILE

Tektronix Phaser PX
Tektronix Inc., P.O. Box 1000, Wilsonville, OR 97070; (800) 835-6100.
List Price: $7,995; upgrade to 10MB RAM, $1,500.
Standard Warranty: 90 days on parts and labor, on-site.
Dimensions (HWD): 12.8 x 34 x 20.5 in.
Weight: 99 lbs.
Emulations: PostScript emulator, HPGL.
In Short: The Phaser PX offers brilliant color, 300-dpi resolution, and PostScript and HPGL compatibility. In addition, it's Pantone certified, and has the lowest list price of the current crop of PostScript-compatible thermal color printers.

CIRCLE 673 ON READER SERVICE CARD

once, you shouldn't have any trouble on subsequent attempts.

Two notable features are the printer's ability to connect to three different computers through its serial port, parallel port, and AppleTalk port, and its automatic queuing of print jobs to the limit of its memory. You can also use a disk-based setup program to set the Phaser PX so that one port will default to HPGL mode, while another defaults to PostScript mode. Using the printer is trivial, since there are no controls. Simply load your software, and install it for color PostScript. A *Microsoft Windows* 3.0 page-description file for the Phaser PX comes on-disk.

Two notable features of the Phaser PX printer are its ability to connect to three different computers through its serial port, parallel port, and AppleTalk port, and its automatic queuing of print jobs to the limit of its memory.

One minor problem we ran into on the fonts and features test was that with letter-size paper the printer lost 1.5 lines of text at the top. The large margin is a result of the rollers that have to maintain accurate registration as the page passes through the printer multiple times. Tektronix says that you can get a full 8.5- by 11-inch image by using legal-size paper. And indeed, when we tried the test with the larger paper, the top line and a half appeared on the page as promised.

Legal-size paper is the largest the printer can handle. A nice touch is that the one tray can adjust for either legal- or letter-size. Capacity is 100 sheets of thermal transfer paper, or 50 sheets of transparencies. Cost per page—including the paper or transparency—varies from $0.18 per page when using a black ribbon on letter-size paper to $1.74 per page for the four-color ribbon on a legal-size transparency. With a legal-size page, the cost is $0.57 per page for a four-color ribbon, or $0.46 per page for a three-color ribbon. The only option for the printer is a $1,500 memory upgrade from 6MB to 10MB.

Tektronix stresses that the Phaser PX is aimed primarily at producing transparencies and boardroom-level graphics, and, from what we've seen, the printer can definitely fill that need. Significantly, at $7,995, the Phaser PX has a lower list price than either of its most obvious competitors—the QMS ColorScript 100 Model 10 and the NEC Colormate PS. It remains to be seen if that list price will translate to the lowest street price, but the Phaser PX is certainly a contender. ■

Bill O'Brien, Alfred Poor, *and* **M. David Stone** *are all contributing editors to* PC Magazine.

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DATA ON THE GO: Three Cellular Modems

by Alan A. Reiter and M. Keith Thompson

With some cellular telephones costing less than $200 in the United States, yuppies and Hollywood celebrities aren't the only people yakking away over the airwaves. About 5.5 to 5.7 million subscribers will be using cellular systems throughout the United States by the end of 1990, estimates Herschel Shosteck, an economist specializing in the cellular industry. By 1995, says Shosteck, the figure will be between 18 and 22 million people.

InfoCorp, a company that monitors trends in the computer industry, estimates that 2 million IBM-compatible portable computers—85 percent of them battery powered—were in use at the end of 1989. Projections indicate that the portable computer market as well is likely to triple by 1995, suggesting that the growth of the two technologies is intertwined. It's a good bet that many people using portable computers will also subscribe to cellular telephone service.

But despite the sales spurt in cellular systems, few of the millions of subscribers are currently using the airwaves for data transmission. Sales figures of modems designed specifically for cellular technology show that only some 15,000 people are transmitting and receiving data over cellular networks.

COMPUTER GRAPHIC: DAVID FOSTER

One reason is a lack of marketing push by cellular carriers. Cellular system vendors are doing so well selling voice services that they have no need to concentrate marketing efforts on data transmission. And although many carriers are interested in potential data applications, they haven't seen much of a demand for them yet—nor have they spent much time looking at the data market.

Also, moving data over cellular systems isn't as simple as it might seem, or ought to be. Indeed, after weeks of experimentation at PC LAN Labs, we think that setting up a cellular data system is a task you won't want to tackle without expert help. Besides needing cumbersome, specialized interface devices, you'll have to decide between very different proprietary modem architectures and deal with a wide variety of problems concerning the time of day, location, type of telephone, type of carrier, and even the type of antenna you use to send data. The bottom line is that although you can configure a system to move data over a cellular phone link and have it work well, you'll either need help from an experienced local company or will undergo a lot of frustration getting things to work.

Moving data over cellular systems isn't as simple as it might seem, or ought to be.

CELLULAR LINEUP

In this review, we examine three cellular communications options: the $4,363 laptop, ITC 386 PEP, with an integrated cellular modem from Intelligence Technology Corp., the under-$2,000 cellular modem pair (C96 and M96) marketed by Microcom Inc., and the $1,245 CellBlazer made by Telebit Corp.

Spectrum Cellular, the first company to offer a cellular modem, is missing from our lineup because of inconvenient timing. Spectrum is in the process of changing its product line and was unable to send us any new equipment for this review, but it did give us a great deal of advice and insight. Spectrum has been working with Rockwell International on the chip set for a new internal 2,400-bit-per-second cellular modem in Toshiba's laptop line. Expected to be available as an option by late 1990, it will have built-in error-correcting protocols including SPCL, MNP 5, V.22, V.22bis, V.42, and V.42bis.

Also missing from this lineup is the Cellmodem 2400 Plus from Cellabs of Canoga Park, California. The Cellmodem has send-only fax capabilities, supports MNP 5, and retails for $595.

HOW CELLULAR COMMUNICATIONS WORK

Cellular networks produce lower-quality transmissions because they are line-of-sight radio systems, subject to loss of signal and fading due to physical obstructions, reflections from buildings, and distance. Cellular signals are broadcast between the cellular phone's antenna and transceivers located within each system's coverage area.

Each transceiver's coverage area, which generally comprises a radius of 2 to 12 miles, is called a **cell**. Cells in busy urban areas have very limited coverage, in part to reduce out-of-phase reflected signals, known as a *multipath*. To ensure continuous coverage, the cells overlap.

All the cells in a system are connected to a central computer switch called a **Mobile Telephone Switching Office (MTSO)**. The MTSO constantly monitors the signal quality on the channels of each cell, and when the quality drops below a certain threshold, the MTSO searches for a higher-quality channel from another cell site. Through a unique switching technique called a **hand-off**, the central computer then hands off, or switches, the transmission to the better channel in the next cell. A brief loss of signal occurs during the hand-off. If the closest cell is busy, the MTSO will connect a subscriber to a channel on a distant cell. Licensing by the FCC for each market area of the U.S. is limited to two cellular operators per market. In each market, operators are authorized to use a maximum of 416 channels within the 800-MHz band.

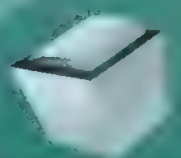
A subscriber using a cellular phone while speeding down the highway will experience many more hand-offs than if the car were stationary. But because of varying traffic loads on cells, the MTSO can order a hand-off even if the subscriber is standing still. Subscribers in urban areas will have many more hand-offs than those in rural areas because of smaller cells.

Cellular systems use analog technology. They were designed specifically as radio networks for voice communications. This presents some challenges for cellular data transmission. When the MTSO commands the cellular phone to switch channels, the transfer takes anywhere from 200 to 1,200 milliseconds to happen, though generally not more than 800 ms. During a voice conversation, callers often hear a low click during hand-off, and the conversation continues normally. But when hand-off occurs during a data transmission, the typical land-line modem interprets it as a loss of carrier and disconnects the communication. Simply setting your modem for a delayed disconnect through the Hayes Standard AT Command Set solves this problem.

In addition to hand-offs, data transmissions are subject to interference from the phone's being powered down by the cellular system. To reduce interference between phones and to balance system traffic, the MTSO can send a signal ordering the phone to decrease its power output. For example, a 3-watt phone might be signaled to operate at 0.6 watts, and then powered back up again.

A modem also has to cope with less esoteric problems, such as gaps in coverage. No cellular system provides full coverage all the time and in all locations. For example, buildings, mountains, and trees can block a signal. It's a lot easier to obtain a strong and clear signal over the flat terrain of the Midwest than in the steel and concrete canyons of New York or the deep forests of the Northwest. Trying to place a call from inside a building, especially if you're in an elevator or on a floor that's below ground level, can be an exercise in futility.

While cellular data transmission may seem less than reliable, selecting communication products that use MNP and SPCL error-checking protocols can ensure data integrity for those who have to move data on the cellular system highway.



MTSO (Mobile Telephone Switching Office)

THE TRUTH ABOUT PORTABILITY

If you want to transfer data over a cellular system, the type of phone you buy is an important consideration. In-vehicle phones and transportable phones (which weigh about 4 to 8 pounds) operate at a maximum of 3 watts; some even have an RJ-11 jack built in. Portable phones (which weigh between 12 and 22 ounces) operate at 6 watts. But many of the phones you can buy, especially the smaller-size portables, do not and will not have a way to interface to a modem or fax machine.

The one thing that manufacturers of cellular data communications products seem to have in common is their lack of understanding of the working environment. Normally, when you think of cellular devices, you picture small, portable, battery-operated products. But the unpleasant truth is that equipment needed for cellular data transmission tends to be so large as to be difficult to install in any vehicle smaller than a van and requires more cables and connectors than a local area network. One rare exception is Motorola's The Cellular Connection, but it works only with specific Motorola telephones.

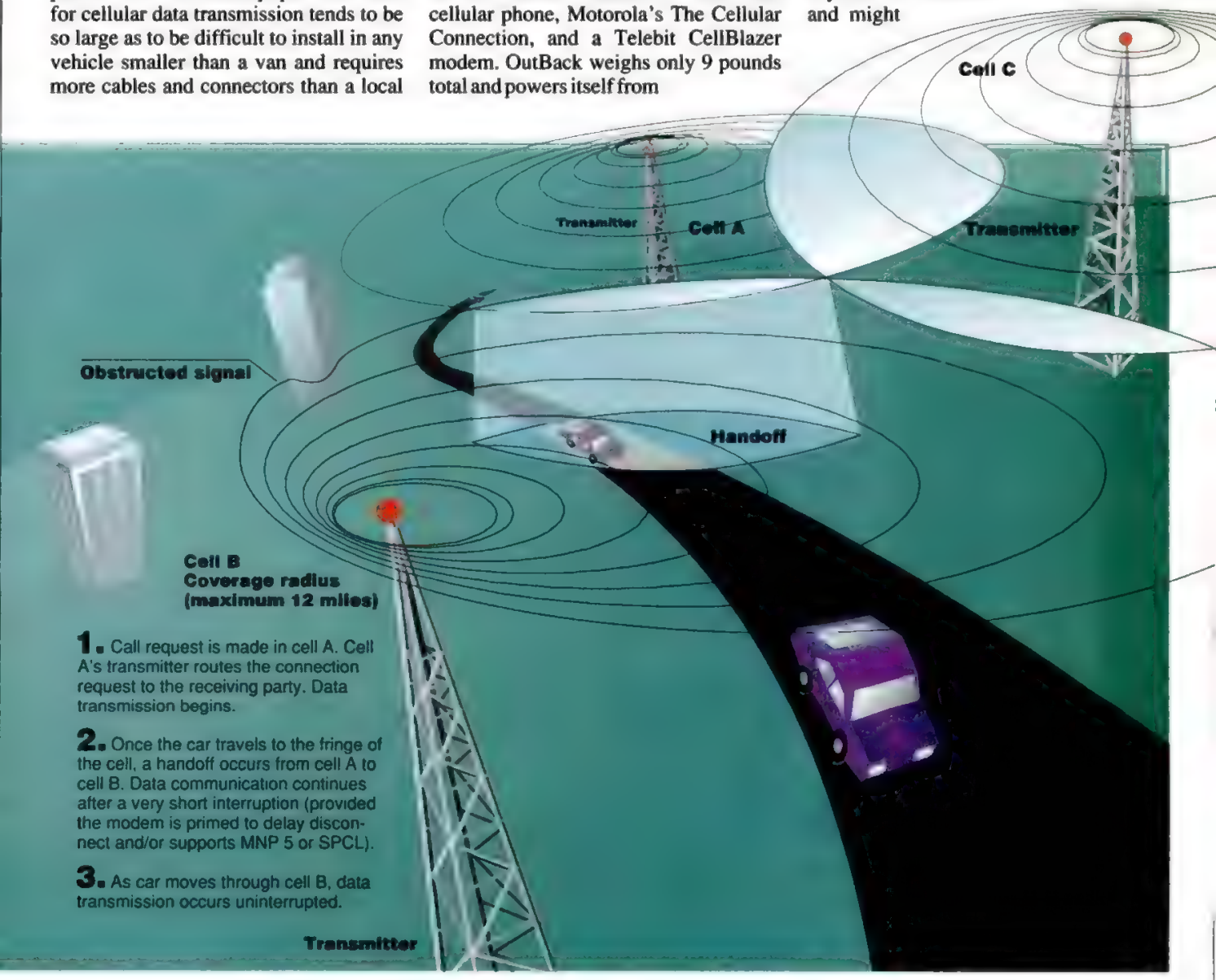
The Microcom and Telebit modems are each larger than any existing cellular telephone. These two modems were not designed to be conveniently mobile. The CellBlazer, with its own power supply and a much-needed third-party 12- to 120-volt AC converter, weighs nearly 8 pounds—more than many laptops these days. Microcom's M96 could stand to go on a diet, as well.

One interim solution is on its way to market. Eagle Cross in Chicago, Illinois (312-247-8222) is about to ship a completely self-contained unit named OutBack. OutBack consists of a Motorola cellular phone, Motorola's The Cellular Connection, and a Telebit CellBlazer modem. OutBack weighs only 9 pounds total and powers itself from one of three sources: 110-volt AC, 12-volt DC, or rechargeable batteries. It also includes a switch for operation from a standard telephone line. With this product, you truly have a one-piece walking cellular communications station.

CONNECTING TO CELLULAR PHONES

On average, street prices range from about $400 to $600 for an in-vehicle, or transportable, phone and from $500 to $800 for a portable. But buying the phone is only the first decision—and the easiest.

If you think that finding a hotel room with an RJ-11 jack is difficult, try finding a cellular phone that has one. A few in-vehicle and transportable cellular phones may come with one, but at present no portable phones do. If you do have one, however, then you have a "dumb" dial-it-yourself interface and might



not need anything smarter.

Smart connectors, on the other hand, have auto-answer and auto-dial capabilities that let your communications software dial a remote computer automatically; they are sold as external black boxes. The dumb versions, which also are available as separate devices, make you use the handset's touchpad to dial out. (For more on smart connectors, see the sidebar "The Portable RJ-11.")

Telular Inc. (Wilmette, Illinois; 708-256-8000), has a patent for its smart CelJack, which retails for $480. Motorola's Cellular Subscriber Group (Arlington Heights, Illinois; 708-576-0537), has licensed the use of Telular's technology for a similar product that it calls The Cellular Connection and sells for $395. And Cellabs (Canoga Park, California; 818-773-2020) sells its Datajack, a dumb interface, for $145.

Several cellular equipment manufacturers market the Datajack under their own labels. To use Cellabs' interface, you plug your modem's RJ-11 cable into the Datajack's RJ-11 jack. Then you unplug the coiled cord connecting the cellular phone's handset to the cradle and, in its place, attach the Datajack's cables to the handset and cradle. The Datajack uses the

THE PORTABLE RJ-11

by M. Keith Thompson

About the only thing a cellular phone has in common with a regular telephone is a ten-digit phone number. Technically, cellular phones resemble FM police radios more than telephones. When you want to connect a modem or fax machine to a cellular phone, you need the familiar RJ-11 phone plug and the underlying circuitry to make it happen.

There are two types of interfaces that simulate portions of the telephone network. We refer to them as intelligent and nonintelligent, or "dumb," data interfaces. These interfaces provide a connection similar to the one on a standard telephone.

The nonintelligent data interface basically provides a voice or data path to the cellular phone. Its hardware is simply two wires and the RJ-11 plug for the modem. This approach allows limited control over the connection to the cellular phone. For example, there's no automatic dialing or reception capability from the communication software. Calls and answers have to be entered manually from the cellular phone's keypad. Once the call is established, the interface places the modem into the audio path of the call. If your communication software does not include support for manual operation, you need new software or an intelligent interface.

In the course of our reviews we used two intelligent data interfaces, the CelJack from Telular and The Cellular Connection from Motorola. Telular and Motorola both hold patents on the technology and are cross-licensing each other's technologies. These two products allow modems to place and receive calls automatically—just like land-line phones.

Telular's CelJack and Motorola's Cellular Connection are more alike than they are different. In addition to making a data path to the cellular phone, they both simulate the telephone company's equipment by creating a dial tone and sending voltage to ring the modem. In each case, the data interface connects between the radio handset and the transceiver. Each type of interface comes with an RJ-11 jack to accept the modem or fax card cabling. While they offer the same basic functions, they differ in size and implementation.

The Cellular Connection (right) and CelJack (left) provide intelligent data interfaces.

Telular's $480 CelJack works with most of the cellular phones on the market. The CelJack models are phone-specific, so there has to be a correct match between cellular phone and CelJack model. On some phones the installation process requires making connections inside the handset. On the PC LAN Labs Uniden CP2000, the CelJack plugged right in and started displaying the phone's status with its six LEDs.

The CelJack's design is its major disadvantage, though. Weighing in at 2 pounds and measuring 1.5 by 6.5 by 8 inches, it's made to be mounted in a vehicle rather than carried around with a phone and a laptop. Because the CelJack has to run off the same power source as the phone, you can't operate the portable phone from its internal battery. This restricts you to a vehicle, or to the length of cigarette lighter adapter cord. All the same, the CelJack is a fine piece of equipment.

Motorola's $395 smart interface is the more attractive solution to the portability problem, but it works only on Motorola phones. The Cellular Connection's size and convenience wins hand down. It weighs 5 ounces and is about the size of a garage door opener. The Cellular Connection attaches to the handset cradle and matches the form of the phone. Such a match of form and function is difficult to find, but then Motorola has a lot of experience with moving data over FM radio and cellular mediums.

The need for fully portable RJ-11 connections over cellular systems is being addressed. But what this segment of the telephone industry needs most is standard connections between products from different vendors. ■

...Nor Dark of Night

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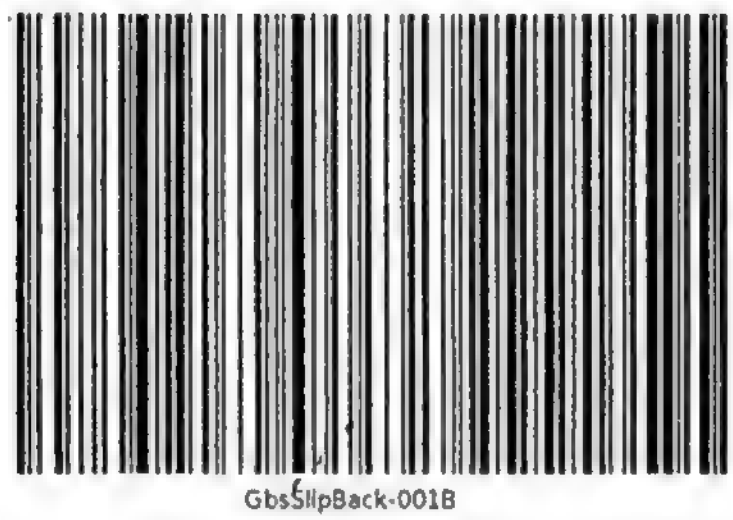

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power from the cellular phone.

Telular's CelJack is a little more complicated to install because of the power connections. There are two choices. The easiest is to run it from your vehicle's cigarette lighter: Buy a cigarette lighter plug adapter for a few dollars and connect the CelJack to it. If, however, you already run your telephone from the lighter socket, you'll need a special (and very ugly) double-ended power adapter. Alternatively, you can open the cellular transceiver and tap into the phone's positive battery connection to power the CelJack. It doesn't take long, but it's not a job for someone unfamiliar with electronics.

HANDHELD PHONES

Until recently, people who wanted to use handheld phones for data transmission were out of luck, except for those brave souls who tried acoustical coupling. Soon, however, interfaces will be available for two such models: the NEC P300 and the Novatel PTR800/800A portable phones.

Spectrum Cellular (800-233-2119), a Dallas, Texas–based company that markets its own 1,200-bps modem featuring its proprietary SPCL error-correcting protocol for cellular data transmission, has acted in conjunction with these two companies to develop products that work with their phones. The NEC/Spectrum interface snaps onto the back and bottom of the P300 and incorporates an RJ-11 port, as well as connections for both a tape recorder and a phone headset. NEC even has a smart and a dumb version scheduled for late 1990.

In contrast, Novatel sees a much greater demand for using a cellular modem with a facsimile machine than with a laptop computer. Hence it has developed the Novatel Faxer, which has a dumb interface that includes an RJ-11 port and connects to the phone's audio bus, to use with its PTR800 and 800A.

CELLULAR SYSTEMS

For all the hype about the high quality of cellular voice calls, the reality is that on average, the quality is not as good as on regular telephone lines. The same holds true for data transmission. Many factors affect the quality of the radio signals, including *hand-off*—the signal transfer routine unique to cellular systems (see the diagram "How Cellular Communications Work"). Hand-offs are a major factor in determining the throughput and reliability of a data or fax transmission; within a cellular system, they can occur at any time.

The extra noise, the limited bandwidth, the rapid fade, and the hand-offs are all factors that can make the cellular system connection a difficult path for data and fax modem communications. It's not an impossible task, though.

FAXING ON THE ROAD

Faxing documents with a portable fax machine or portable fax card often works better over cellular telephones than sending land-line modem data because the Group III fax protocol was originally designed to work over poor-quality phone lines around the world. However, the protocol lacks error correction, so you could lose some data. But unlike in ordinary binary file transfers, if the fax document transmission loses some bits, the end result is still readable.

Depending on the type of data interface you select, faxing from your vehicle can be as easy as it is in the office. With a smart data interface, your fax machine will auto-dial/send and auto-answer/receive just like at your office. With a dumb data interface, you place the call with the cellular phone and connect with the remote fax, then hit the Start/Send button on your fax machine to send. When transmission is complete, terminate the call with your cellular phone's End button. To receive a fax, you simply answer the call with the cellular phone's Send button and hit the Start/Send button on the fax machine.

Faxing is far more common over cellular phones than data transfer. Many companies offer products to do the job. Portable fax machine vendors include Fujitsu (800-243-7046), Mitshubishi (708-860-4200), Medbar (718-335-0404), and Nissei (201-768-1520). These products operate on their own batteries or a cigarette lighter adapter.

Faxing on the go is simple; reading the rolled up pieces of paper while driving is dangerous. But until people become more comfortable with computers, they will continue to use fax machines to communicate. As microcomputer and communications technology advances, cellular faxes will help bring about the portable office. Before long, for example, our car might call a local repair shop to order a worn-out part and schedule an appointment without our help.

MODEM CHOICES

Despite the difficulties of cellular communications, you still might be able to make do with a typical V.22bis 2,400-bps modem and a communications package designed for use with terrestrial telephone

PC MAGAZINE EDITOR'S CHOICE

• Microcom C96 and M96

In a serious cellular data installation, a battery-operated external modem equipped with the MNP 5 error-checking and data compression protocol isn't a bad choice for mobile communications. Telebit's CellBlazer moves data over the airwaves more quickly, but the M96 provides more-reliable connections than either the CellBlazer or the ITC 386 PEP over cellular links. Given the nature of the cellular beast, that's not bad.

Like the Telebit CellBlazer, the Microcom M96 isn't really ready to hit the road. Both are configured for desktops—not backpacks, laptops, or vehicles. However, Microcom provides a 12-volt power alternative for its cellular modem and better integration with a variety of cellular telephone RJ-11 interfaces. The CellBlazer requires 120-volt AC power. Take it on the road, and you'll you have to find some way to get it power.

Cellular data transfer with the ITC 386 PEP, while no less portable than any typical laptop, was rated for 2,400-bps transmission but only performed at 1,200 bps. There's price to consider, too. While $4,000 is not too much to pay for a laptop, it's a lot to pay for a cellular modem.

With cellular data communications, it still takes some patience to get a good connection. The Microcom modems were the easiest to connect and transfer data between. Although they did not provide the fastest throughput, they worked well under changing conditions.

The M96 is far from portable and it's large even for mobile installations, but it's our choice for a modem.

lines. It depends on your requirements for reliability, your location, and your tolerance for frustration.

In areas where you get a strong cellular signal, the difference in power output between transportables and portables doesn't matter much. But at the fringes of cellular coverage, the amount of higher power available makes all the difference between a successful data file transfer and no transfer at all.

If you need to use a cellular telephone for data transmission in a specific area where the signal strength is good and your cellular phone can accept transmission speeds of 1,200 bps or 300 bps with even slower effective throughput, then you can use standard modems and communications software over the cellular link. We strongly suggest using modems with MNP 5 or V.42 error-correction capabilities. We also recommend using communications software with a robust file-transfer protocol such as Kermit for the file transfer sessions.

The only trick to using a standard modem on the cellular line is to send the Hayes command ATS10=12 to the modem to tell it to wait 1,200 milliseconds before declaring a lost carrier. This time delay ensures that the modem will stay connected during a cell hand-off. You might want to increase the =12 to an even higher number in areas where you experience strong fading of signals.

For other situations, you'll do much better by shelling out several hundred dollars more for modems and software designed specifically for cellular operation, such as those offered by Cellabs, ITC, Microcom, Spectrum Cellular, and Telebit. Microcom and Telebit have enhanced their existing land-line protocols and market their modems for harsh radio and telephone line environments, not just for cellular use.

Products from these companies must cope with the vagaries of transmitting over the air by using such techniques as increasing or decreasing the transmission speed, changing the size of the data packets, and making many attempts to overcome transmission interference during the initial connect stage when the signal is most likely to be dropped. They also feature data compression, ranging from ratios of 2:1 to 4:1, which can dramatically increase throughput.

It's no surprise to find that the best test results are seen when each company's proprietary error-correcting protocol is used. To take full advantage of these protocols, it's necessary to buy two modems: one for the host and one for the remote computer. However, since so many cellular operators have installed Spectrum's modems at their cellular management centers, the SPCL cellular protocol can be used over the radio channels between the laptop's cellular modem and the switching office. Hence, if you decide to purchase a Spectrum Cellular modem, you might need only the one for your laptop.

It's no surprise that you get the best test results with each company's proprietary error-correcting protocol.

Without another SPCL modem at the host computer, transmission over regular telephone lines between the cell site and the host computer does not include error correction. However, the land lines are much less prone to producing errors than the radio channels.

BURNING THE AIRWAVES

Of all the products we tested, Telebit's CellBlazer moved data fastest over the cellular link, averaging nearly 14-kilobit-per-second transfer rates with compressable files in PC Labs' performance tests. Microcom's MNP 10 modems weren't as fast but performed more reliably.

These fast speeds are especially valuable when transmitting long text files and graphics files that can easily measure half a megabyte or more. The faster the transmission, the less air time used. The better the reliability, the fewer retransmissions. Both save money. In the United States, monthly access fees range from about $15 to $35, and that doesn't include the cost of the calls. Calls are billed at about 20 to 60 cents per minute, in 60-second or 30-second increments. The average total monthly bill is $84, but many businesses tend to spend much more.

Our tests leave little doubt that cellular telephone systems can be an efficient transmission medium for portable data communications. But mere efficiency isn't necessarily enough in a business tool. Many potential users could find it frustrating to contend with interface devices, AC/DC power inverters, cigarette lighter adapters, and thick, black cables cluttering their vehicles. On top of all that, the external modems we evaluated are far from our ideal of portability: 3-pound boxes the size of hardcover books turn the "mobile office" into the "luggable office."

Some mobile communications experts think the use of fax machines with cellular phones will be more popular, at least in the short term, than with laptops. Fax machines are easy to use, and business people feel more comfortable sending a fax than learning a communications program to send electronic mail.

One development that will affect data transmission is the switch from analog to digital cellular systems. Cellular was probably one of the last major communications networks to begin its commercial life in the analog world. During the next several years, cellular operators will spend hundreds of millions of dollars changing to digital. Because of this, cellular phones will be offered with both analog and digital capabilities; consequently, they're likely to be larger and more expensive.

Unfortunately for proponents of data applications, the first generation of digital networks will not include standards for transmitting data. Some mobile communications observers say it's an indication of the cellular industry's lack of interest in data or lack of foresight. Others say the industry just didn't have sufficient time to develop both voice and data standards, and left data for the second generation. No matter what the reasons, the lack of standards is likely to hamper the development of digital data products and increase their costs.

Cellular data communications is in its infancy. Like any young industry, the users, resellers, and vendors need to communicate and cooperate. With industry growth comes improved products and service. For now, we recommend you contact a reputable and experienced reseller. Insist on an on-site demonstration under varying conditions to test for the greatest reliability.

Even though our reviews focus on

The numbers outside.

cellular modems, the modems are only a small portion of the cellular data equation. We used products and services from other companies that deserve recognition.

Cellular One in Fort Walton Beach, Florida, provided us with its air time and a Uniden transportable phone. The company's staff was helpful and professional. They quickly responded to our problem of not being able to use the Telebit CellBlazer on Cellular One's system. The system's engineers immediately contacted Telebit to work on a solution.

Southwestern Bell in Dallas, Texas, also provided us with air time and expert help. Southwestern Bell installs a large amount of data equipment in its markets. Since Southwestern Bell has had experience with all of the products we tested, it provided a great deal of insight into the dos and don'ts of cellular data transmission.

INTELLIGENCE TECHNOLOGY CORP.

ITC 386 PEP

All reviews by M. Keith Thompson

The ITC 386 PEP from Intelligence Technology Corp. is currently the only laptop on the market that comes with an affordable internal cellular modem option. The $4,363 unit teams respectable computing power and a sizable hard disk while producing cellular communications in a relatively compact package.

The 386 PEP uses ITC-RM (for Reliable Mode) as its cellular error-correcting protocol. ITC-RM is a modified MNP 5 protocol capable of adjusting to smaller block sizes so that it can handle the many repeats required over marginal communications circuits more efficiently. MNP 5 block sizes typically vary from 64 to 256 bytes. When many errors occur, the communications software adjusts the blocks to a smaller size, reducing retransmission time. ITC-RM allows the block size to shrink down to 16 bytes, thereby keeping retries to a minimum.

The 386 PEP modem can communicate with most other types of modems. Since it works with MNP 5, V.22bis, Bell 212A, and Bell 103 standard modems at a maximum rate of 2,400 bits per second, users can transfer data to other services over normal phone lines.

Computing power for the 386 PEP battery-operated portable comes from a 16-MHz 80386SX microprocessor. The ITC laptop includes a backlit VGA display and an internal 40MB hard disk. (For more information on the computer, see "Power Portables: The Next Wave," *PC Magazine*, October 16, 1990.)

In our evalulation of this integrated laptop/cellular modem system, we found the modem would not connect at 1,200 bps though it was rated for 2,400-bps operation. ITC assures us that this temporary problem has been corrected in production models. But because of the slow connected signaling speed, the throughput rate for the 386 PEP devices were low—nearly 5 kilobits per second less than that of the CellBlazer on the noncompressed file transfer. Logically, the numbers should be more in line with the

FACT FILE

ITC 386 PEP
Intelligence Technology Corp., 16526 Westgrove Dr., Dallas, TX 75248; (800) 356-3493 or (214) 250-4277.
List Price: $4,363
Requires: Cellular phone service, cellular phone, data interface.
In Short: ITC offers the only laptop computer with a built-in cellular modem. The 386 PEP's size and portability make it a good choice for someone without a laptop. The cellular protocol works well and produces reasonable throughput.

CIRCLE 657 ON READER SERVICE CARD

CELLULAR MODEMS: SUMMARY OF FEATURES

Products listed in ascending price order

In addition to conforming to land-line modem standards, cellular modems depend on special error-checking protocols to achieve reliable data transmission across the airwaves. Telebit's Packetized Ensemble Protocol (PEP) adapts throughput to cellular channel noise, while ITC uses its Reliable Mode protocol (ITC-RM) to alter data block sizes in response to data errors. Microcom developed and licenses the MNP error-correcting and compression protocols; for cellular modems, it offers MNP 10 to detect cellular data transfer errors and order resends from the source when transmission errors occur.

	Telebit Corp. **CellBlazer**	Microcom Inc. **Microcom C96** and **M96**	Intelligence Technology Corp. **ITC 386 PEP**
List Price	$1,245	$1,898 (C96, $899; M96, $999)	$4,363
PHYSICAL CHARACTERISTICS			
Type of unit	External modem	Modem pair: C96, host; M96, remote	Laptop with internal modem
Dimensions (HWD, in inches)	2.5 x 8.5 x 13	2 x 6.5 x 11	2.5 x 11.8 x 12
Weight (pounds)	3	3	8
Cigarette lighter adapter for use in an automobile	None (needs only 12V converter)	Required (for M96 only)	None (laptop is battery-powered)
Status lights	■	■	❑
MODEM STANDARDS COMPATIBILITY			
Bell 103	■	■	■
Bell 212A	■	■	■
V.22	■	■	■
V.22bis	■	■	■
V.32	❑	❑	❑
V.42bis	❑	❑	❑
ERROR-CORRECTING PROTOCOLS			
Proprietary cellular protocol	PEP	MNP 10	ITC-RM
MNP 4	■	■	■
DATA COMPRESSION STANDARDS			
MNP 5	■	■	■
MNP 7	❑	■	❑
Lempel-Ziv	■	❑	❑

—Editor's Choice ■–Yes ❑–No

The computer inside.

Since buying a computer today is such a numbers game, here's a simple rule of thumb. Look for 386™SX, 386™ or 486™ on the outside to be certain that you have Intel technology on the inside. From the company that invented the microprocessor. The company that has shipped over 10 million 32-bit processors. The same company that's investing over $1 billion this year to make sure the computer inside your computer has the technology, power and compatibility to take you into the future.

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throughput of the Microcom modems at 2,400 bps.

Unlike the other modems tested, ITC does not currently market a desktop or host model; consequently, ITC-RM file transfers work only from one PEP laptop to another.

The 386 PEP combined with a Motorola phone and Cellular Connection make a nice two-piece cellular data package. If size, convenience, and weight influence your buying decision, ITC should be high on your list. However, a host model is not yet available.

CELLULAR NETWORK ALTERNATIVES

by Alan A. Reiter

Cellular voice network isn't the only way to transmit data over the air, and it isn't always the best. For example, cellular uses circuit switching so the user has to dial the telephone number, wait for the modem connection, transmit the message, log off from the host-computer's program, and disconnect the terminal.

Radio networks specifically designed for data can effect shorter set-up times for calls and eliminate many keystrokes. In the time it takes a terminal to make a connection over a cellular system, a terminal on a packet-switched network can transmit thousands of characters.

Last January, IBM and Motorola announced a joint venture called Advanced Radio Data Information Service (ARDIS) to establish a nationwide packet-switched data service. ARDIS combines two existing networks: IBM's own wireless data network for its field technicians, which Motorola built, and three wireless Motorla-operated local public data networks.

According to ARDIS, its network covers some 8,000 cities and towns in the continental United States and operates at 4,800 bps.

Motorola manufactures a portable and an in-vehicle terminal for the network. Each unit includes a radio and a modem (actually, a packet assembler/disassembler).

For customers who want to use other brand-name laptop computers or handheld terminals, Motorola offers a $2,500 radio modem. ARDIS figures the total monthly air time cost per user will be $100 to $150.

Competing against ARDIS is Ram Mobile Data. Ram hopes to lure customers such as field service personnel, utilities workers, and couriers away from ARDIS. Ram uses a packet-switched network architecture called Mobitex, which was developed by Ericsson and Swedish Telecom.

Ram Mobile Data hasn't priced its service yet, but early estimates are in the $75 per-month per-user range, including air time and messages.

Ram is authorized to operate in 50 top U.S. market areas. The company says it will begin services in about 10 market areas by January 1991. Ram will charge 6 to 12 cents for each 512-byte packet, plus a monthly access fee. The network will operate at 8,000 bps.

ARDIS customers must buy the radio modems for its system from Motorola, while RAM provides Mobitex specifications to all vendors who want to build products for the network.

Both ARDIS and Ram are much more applicable than cellular voice networks for dispatching applications. Cellular might be preferable for transferring text-only files and extensive on-line sessions.

For one-way wireless data, an intriguing new network will use radio paging technology. Motorola is purchasing Contemporary Communications, which holds a national license to transmit pages and other one-way signaling communications. Motorola says it will construct transmitters in 50 to 100 cities by the end of 1991, with another 100 to follow.

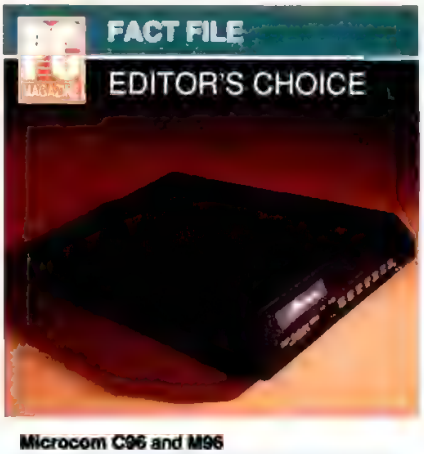
Motorola will offer external and internal "pager modems" that can be used with laptop computers and electronic pocket organizers. The company suggests that the technology might be used for such applications as transmitting updated price lists to salespeople or alerting field executives to scheduling and appointment changes. ■

MICROCOM INC.
Microcom C96 and M96

Microcom makes many types of modems, but markets two especially designed for cellular communication. Meant to function as a team, the M96 ($999) gets its power from a cigarette lighter in a vehicle, while the C96 ($899) attaches to the host computer for a land-line connection. These two modems are an excellent solution if your primary method of communication is cellular.

Microcom developed and licenses the Microcom Network Protocol (MNP), the most widely used error-correction and compression scheme for dial-up modems. Since Microcom was so successful with MNP 4 and MNP 5, it is now trying to make the MNP 10 cellular error-free file-compression protocol the de facto standard. Fact is, other cellular modem manufacturers want their protocols to be the standard, too. This leaves users stranded on their own protocol islands, able to communicate only with the same type of modem on the other end. At least the M96 and C96 cellular modems incorporate previous levels of MNP—specifically MNP 5—allowing data transmission, at less throughput, to other modems.

In appearance, both modems are iden-



Microcom C96 and M96
Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062; (800) 822-8224.
List Price: C96, $899; M96, $999
Requires: Cellular phone and service, cellular data interface, computer, communication software.
In Short: Complete plug-and-go products, including a cigarette lighter adapter for a vehicle. Simple installation and excellent software compatibility make them a winning combination. Quality products from a reputable modem maker.

CIRCLE 558 ON READER SERVICE CARD

tical. The 2- by 6.5- by 11-inch modems, cased in black plastic, have front-panel controls and LEDs. Two buttons activate answer or originate modes and switch between talk or data mode. An array of seven LEDs displays the various states of the modem's activity and the status of the connection. Neither modem includes an on/off power switch, despite references to one in the documentation. On the back, phone and jack plugs are clearly labeled, along with an eight-position DIP switch, reset button, and volume control.

When communicating with each other, the M96 and C96 use MNP 7 data compression with MNP 10 error correction. Even so, the Microcom modem software built into the M96 and C96 operates as a superset of existing modem standards. This allows one or the other to communicate with all MNP modems, V.22bis, Bell 212A, and Bell 103, but the maximum rate for this duo is 2,400 bits per second. Microcom may have better served the demands of cellular data transfer by adding 9,600-bps support to the host C96. This would allow better throughput for faster land-line communications.

The Microcom modems transferred our test data files reliably. Though not as efficient as the Telebit CellBlazer, the M96 had throughput nearly equal to that of the comparison modem set up for V.22bis, MNP 5 communications. The M96's transfer of the uncompressed file, at 2.73 kilobits per second, was more than twice as fast as that of the ITC internal modem.

Microcom provides fast, reliable, and easily transportable data communications.

On the whole, the Microcom M96 and C96 cellular combination provides fast, reliable data communications. The documentation needs work, and the M96 needs to lose some weight. And although the M96 is as large as the CellBlazer, it was designed to operate on 12 volts in a vehicle, making it easily transportable.

TELEBIT CORP.
CellBlazer

Telebit has been making modems since 1984; over the years, it has also manufactured modems for Ventel and Racal-Milgo. Telebit focuses primarily on the high-speed market: Originally, its TrailBlazer pioneered fast data communication with uncompressed throughput of 18,000 bits per second. Now Telebit is moving its speed demon to the cellular air waves. Its $1,245 CellBlazer offers fast throughput and reliable connections.

Telebit wants Packetized Ensemble Protocol (PEP), its cellular error-correcting protocol, to be the industry standard. PEP modulation uses multicarrier technology to maximize the data-carrying capacity of the cellular bandwidth. Over the cellular network, PEP dynamically adapts to the portions of the channel spectrum with less noise. Multicarrier signal

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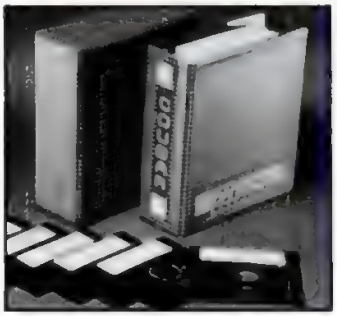

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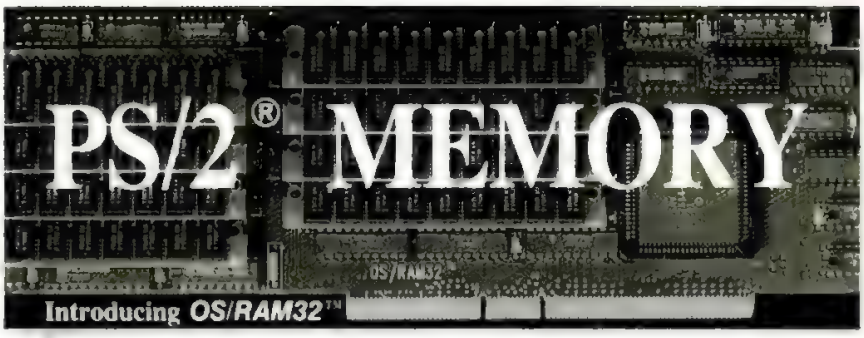

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PC LABS PERFORMANCE TESTS: CELLULAR MODEMS

Cellular modems move data quickly over cellular links; it's getting connected that's the problem. PC LAN Labs had good success using standard modems over the cellular link, and fax transmissions worked well, too. However, many physical and environmental factors—from the brand of cellular phone to the time of day—affect the quality of cellular connections.

HOW WE TESTED

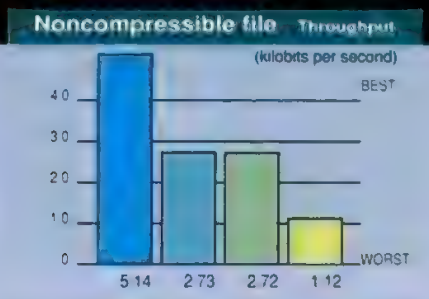
We had to do a great deal of research and experimentation in order to run these few simple cellular file transfers. After many trials and much consultation, we discovered that there is no such thing as a typical cellular environment. Even a cellular telephone sitting on a lab bench is susceptible to hand-offs caused by changing traffic loads on the cell sites. Likewise, there is no way to predict the amount of delay or distortion you'll experience due to hand-offs, power reductions, and gaps in coverage during a file transfer or a fax transmission—particularly if you're moving.

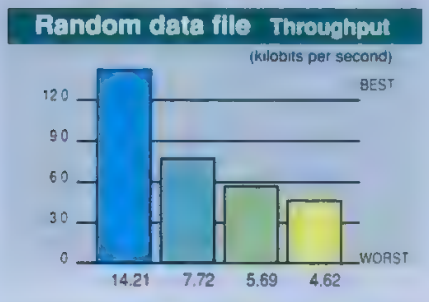
Because of the unpredictable nature of hand-offs and power reductions, we decided to focus on the best and worst signal conditions we could find with no hand-offs or power reductions. Fortunately, we had access to coastal cellular telephone sites with no overlapping coverage from other cells. This enabled us to move very close to the cell for strong signal tests and far away from the cell for fringe signal testing without fear of hand-offs.

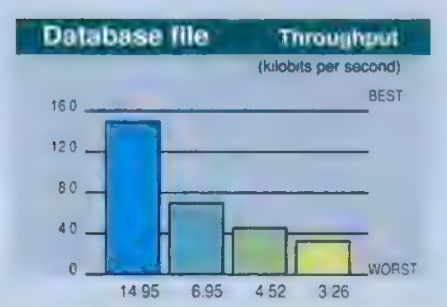
FACTORS AFFECTING THROUGHPUT

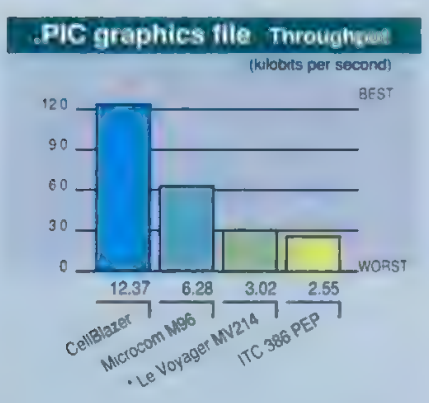
Many factors determine the throughput possible over any given cellular connection. These include the configuration and condition of the carrier's equipment, the traffic load on the cell site, the type of modem, the type and brand of cellular phone, the data interface, the type of antenna on the phone, and the distance from the cell site. Since we found differences in throughput as we changed each variable, we tried to freeze all the variables but the type of modem for our tests. In any real installation, though, all of these factors will constantly interact.

The mobile test bed consisted of several computers, AC power supplies, four telephones, cellular adapters, and a box full of cables loaded aboard a 38-foot Carver Santego motor yacht. The 120-volt power for the equipment was supplied by the craft's AC generator.









For file transfers under strong signal conditions, we positioned the craft literally in the shadow of the cell's transmitting antennas. For weak signal testing conditions, we used LORAN and radar for precise navigation to a position 15 miles from the cell's transmitter.

In order to get a connection marginally adequate for modem communications at the 15-mile range, we had to change to a Telular Marine Cellular antenna providing 6 decibels of gain over the quarter-wave stub antennas on our portable and transportable phones.

When we tested the cellular modem in the ITC 386 PEP, we had to use another 386 PEP laptop on the fixed end because the modems are built in.

PERFORMANCE DIFFERENCES

We accepted modem connections only under the fastest available protocol. Accepting slower connections wouldn't have proven a great deal beyond how long it might possibly take to transfer a file, and we'll grant that this lower limit is somewhere beyond the edge of what is humanly bearable. We found significant differences in the throughput and reliability between brands of modems, but *if* the modem connected using its high-speed mode, we saw no statistically significant throughput differences between the operation of the modem pairs in weak or strong signal areas. Getting the connection is the big problem. Once connected, files roll fairly smoothly across the cellular channel.

The Microcom M96 was the most reliable when it came to connecting in weak signal areas. It connected when none of the others could complete the handshake. Additionally, the Microcom products were the easiest to use, requiring little tinkering with the S registers or additional AT commands.

If you have large amounts of data to transmit, the CellBlazer may be the most cost-effective for you. The CellBlazer's throughput was by far the best. When you are paying 75 cents a minute for air time, the extra cost of the CellBlazer comes back in air time savings. However, try before you buy. Telebit squeezes every last bit of data over the connection, and the CellBlazer may not work in all situations. If it does work with your telephone and carrier, you will be happy with the results.

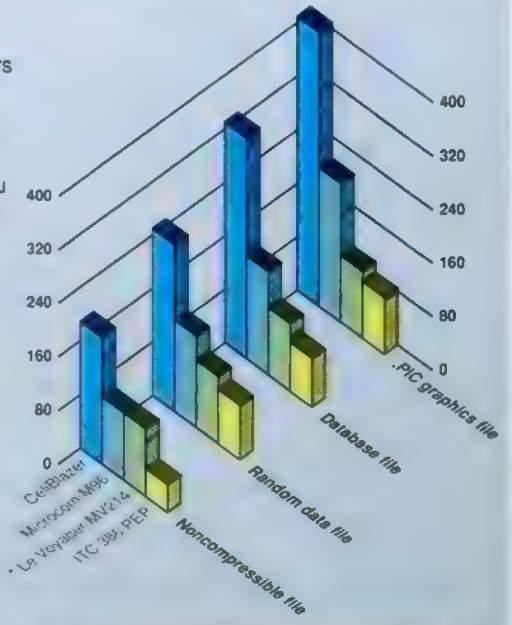
For comparison, we ran the cellular performance test over a tiny battery-operated Le Voyager MV214 modem, marketed by a company called COM 1. Using V.22bis with MNP 5 error checking and data compression on the cellular side, we had a Racal-Vadic modem with similar capabilities on the fixed side. We commanded the modems to ignore loss of carrier whenever possible and moved files across the cellular link repeatedly with good throughput. We even called into MCI Mail and sent and received electronic messages on-line with no problem.

* Reported for comparison.

CELLULAR MODEM FILE TRANSFER TEST

Under both weak and strong cellular signal conditions, we transferred CCITT-standard files from a mobile platform to a host system. The files, holding approximately 50K each, included a noncompressible file and compressible random data, database, and .PIC graphics files. All performance is measured in kilobits per second. The throughput numbers shown in the graph represent the averaged results of five transmissions under the best available signal conditions and five transmissions under marginal conditions.

On the cellular end of our test platform, we used the ITC 386 PEP laptop computer with its 386SX processor operating at 16 MHz. At the fixed end in PC LAN Labs, the test platform used an ALR PowerCache 486 with an 80486 processor operating at 33 MHz. *HyperAccess/5* communications software from Hilgreave drove the modems on both ends and moved the data files using the Ymodem-G protocol. This protocol doesn't include compression or error detection and is the best one to use when the modems already have these features.



Cellular Modem File Transfer Test
(Taller bars represent better performance)
Relative Throughput
(Le Voyager MV214 using V.22bis and MNP 5 protocols = 100)

The internal cellular modem for the ITC 386 PEP could be evaluated only at 1,200 bps.

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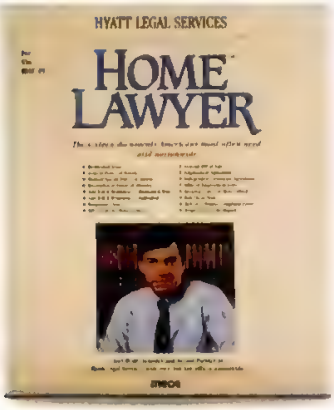

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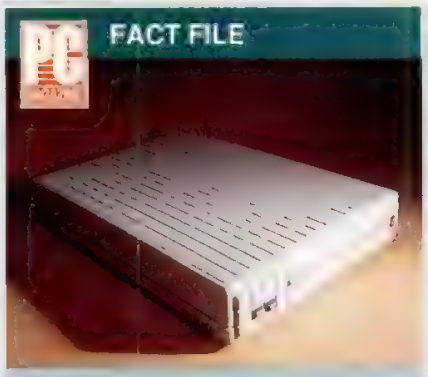

CellBlazer
Telebit Corp., 1315 Chesapeake Terrace, Sunnyvale, CA 94089; (800) 835-3248 or (408) 734-4333.
List Price: $1,245
Requires: Cellular phone and service, cellular data interface, computer, communication software.
In Short: Throughput equal to its name. The speedy CellBlazer's size and weight, with the much-need third-party 12-volt converter, is cumbersome. Recommended for anyone with a lot of data to transfer.

CIRCLE 669 ON READER SERVICE CARD

averaging compensates for fading and impulse noise, eliminating the need for forward error correction. Additionally, the CellBlazer reduces the modulation rate in 100-bps increments, so in theory it can find the optimal throughput rate.

The CellBlazer requires more setup and configuration steps than most modems. Flexible communications software is required to set the various S registers needed to properly configure the Telebit modem for your equipment. For example, you have to set the S175 register on both the cellular and land-line modems for the brand and model of your cellular phone.

Unlike the Microcom C96, the CellBlazer supports land-line speeds up to 9,600 bps, allowing you to put it on all of your host lines. The CellBlazer communicates with the installed base of low-speed land-line and cellular modems at 300, 1,200, and 2,400 bps. It also ably communicates with other high-speed Telebit and PEP-compatible modems. It also supports V.42 and MNP 4 error-correction along with Lempel-Ziv and MNP 5 data compression.

Physically, the beige-colored plastic CellBlazer is large and strong. It measures 2.5 by 8.5 by 13 inches and weighs 3 pounds on its own, growing to nearly 8 pounds with power supply and third-party 12-volt converter. The size and weight of the total traveling CellBlazer package make it difficult to class this device as even a transportable, but its fine performance makes the extra weight tolerable.

Because cellular communications is all about being mobile, the CellBlazer's 120-volt power supply requirement is strange. Given some of the convenient features that Telebit has built into the CellBlazer, it's even stranger that the company does not sell a device to convert 12 volts to 120 volts. Nevertheless, the CellBlazer's connections are well labeled and easy to understand. The front panel includes eight LEDs displaying status information, and two switches. One switch toggles the voice and data connections for talking and file transfer without placing another call. The other switch selects one of two stored default parameter profiles. These user-defined profiles contain S parameter settings and AT commands, so you can reconfigure your modem literally at the flip of a switch. On the back of the modem, the phone and line jacks are clearly labeled.

In our testing of the CellBlazer, we found it to live up to its name. Throughput on compressible random data, database, and graphics file tranfers was almost double that of the Microcom modem.

However, in evaluating the Telebit CellBlazer we discovered that it did not work over the Cellular One system carrier we used. Upon investigation we found a suspect. The cell used for testing is known as a remote cell site. This means that our transmissions were sent by microwave to the main cell site, then hit a land line to go to their destination. According to local cellular operators, remote cell sites typically run a little "hotter" than nonremote sites. Telebit and Cellular One are working to define the problem, but the CellBlazer worked flawlessly after switching to a carrier with nonremote cells.

Cellular data communications is not easy, but then, land-line communication is not simple, either. Using the CellBlazer requires some patience and experience, but with a qualified reseller holding your hand, you should be up and running quickly. If you have a lot of data to send and have good cellular coverage, the CellBlazer works great. ■

Alan A. Reiter is executive editor of the biweekly newsletter Mobile Data Report, *published by Waters Information Services in Washington, D.C. M. Keith Thompson is a regular contributor to* PC Magazine.

by
Barry Simon

Lab Notes

Learning Your Way Around the Keyboard Under DOS, Part 1

Even if you keep a mouse within reach, the keyboard is still your primary interface with the PC. But just how it tells programs what you want to do remains a mystery to most users, so in this Lab Notes I'll present an overview of how the keyboard works at the system level. Programmers will gain an understanding of what's going on under their high-level languages, and users will learn how to better manage their TSRs.

In this Lab Notes we'll be working entirely within the DOS world; both *Microsoft Windows* and OS/2 completely replace the default keyboard driver and so require a different treatment. In the DOS world, the briefest overview of keyboard operation can be given by saying that interrupt 9 processes keystrokes and places them in the keyboard buffer, while interrupt 16h is used by applications to obtain keystrokes from the keyboard buffer. As that terse summary suggests, however, to understand what the keyboard does will require some familiarity with hex numbering, 80*x*86 memory addressing, and interrupts, so it's a good idea to begin the discussion with these things.

WORKING IN HEX

Throughout this discussion we'll be using hexadecimal (base 16) numbers, known simply as hex. Where there's any chance of confusion, we place a lowercase *h* after such numbers as a reminder. Hex numbers need 16 symbols to represent them—six beyond the ten required for decimal notation—so following 0 through 9 come A, B, C, D, E, F. The number Eh is equal to 14 in decimal terms.

Just as the decimal number 123 means 1 times 100 (or 10^2) plus 2 times 10 (or 10^1) plus 3 times 1 (or 10^0), so the hex number 123h means 1 times 256 (16^2) plus 2 times 16 (16^1) plus 3 times 1 (16^0). Thus, 123h is 291 decimal, and, for a more complicated example at random, 13DEh becomes (1*4096 + 3*256 + 13*16 + 14), or 5,086 in decimal.

If you're unfamiliar with working in hexadecimal notation, it may be tempting to try to keep translating hex to and from decimal. In the situations in which hex numbers are used, however, you won't really gain anything by such translations. It doesn't matter that interrupt 16h is 22 decimal or that the start of the keyboard buffer (41Eh) is 1,054 in decimal. Hence, I recommend you regard hex numbers simply as themselves—numbers in base 16.

> ■ DOS programmers and nonprogrammers alike will profit from knowing how this most basic of peripherals operates under DOS.

Even when you do have to do arithmetic, you'll eventually find it much easier to do it in hex, rather than by translating to decimal and back. Consider the following example:

```
 14FD h
 8FA4 h
------
 A4A1 h
```

You once had to learn that 13 + 4 was 17 by counting 14, 15, 16, 17. Likewise, at first you may have to learn that D + 4 = 11h by counting E, F, 10, 11. With practice, however, this process becomes second nature. And if it doesn't, most PC calculators have a hex mode, for the rare occasions that require hexadecimal arithmetic. Even DEBUG will give you the sum and difference, respectively, of two hex numbers if you enter

```
H nnnn mmmm
```

at the - prompt (where *nnnn* and *mmmm* are the hex numbers).

80x86 ADDRESSING SCHEME

A byte has 8 bits and so describes 2 to the power of 8, or 256 possibilities. Since one hex digit corresponds to 4 bits, it requires two hex digits to describe 1 byte. Bytes are thus written in the form *xx*, with each *x* representing a hex digit. Addresses are written in the form *xxxx*:*xxxx*, where the hex number before the colon is called the segment and the number after the colon is the offset. This curious way of writing addresses requires 4 bytes—2 for the segment and 2 for the offset—and is a consequence of the original design of the PC.

With 2 bytes—16 bits, or 4 hex digits—you could address 2^{16}, or 65,536 locations. The 8088/8086 CPUs used by the original PC were designed to access 1MB (that's 1,048,576 RAM locations)—a sizeable amount of memory at that time.

In absolute, or linear, address terms, this requires 20 bits (5 hex digits). Because the CPUs were internally designed to work with groups of 16 bits, however, the rather cumbersome segment:offset scheme—which uses 32 bits to represent an address that could have been expressed with 20 bits—was adopted.

Since there are 12 extra bits and 2^{12} is 4,096, each segment:offset address has 4,096 possible representations. This isn't

strictly true (there are fewer possible representations for addresses below 1,000h), but the principle is clear that the same absolute address in memory can be designated by many different segment:offset combinations. If you start with what is called a normalized address—one in which the segment is as large as possible and the offset as small as possible—you can derive the other 4,095 equivalent representations by repeatedly subtracting 1 from the segment and adding 16 (10h) to the offset. (If the segment is less than 4,096 (1000h), you can't actually do this 4,096 times, because you'll hit zero before you reach that number of iterations.)

To compute the corresponding absolute (linear) address from any of its segment: offset representations, you multiply the number to the left of the colon by 10h (that is to say, you shift it left by one digit) and then add the offset. Thus, the absolute address that corresponds to 1234:ABCD is

```
 12340
  ABCD
 ------
 1CF0D
```

Again, as with the hex/decimal conversion, it is usually not useful to translate from the 32-bit representation into absolute addresses except to determine whether two segment:offset addresses are actually names for the same location.

For example, address 0040:0010 is the same as 0000:0410. To determine this, you shift 0040 left one place (yielding 00400), add the 0010, and you get 00410, the same linear address. In general, you won't often need to create equivalent addresses. Rather, given two addresses, you'll want to know if they are equivalent. To do that, you just convert them both to linear and see if they're the same.

Given a normalized address, however, suppose you do want to find an equivalent address with a different segment. Let's assume the new segment is less than the starting segment by an amount that doesn't exceed 0FFFh. Take the difference between the two segment numbers, multiply it by 16 (10h), and add the result to the offset. That's the offset that goes with the new segment. So, for example, given 0040:0010, suppose you want the offset for segment 0010. The difference is 30h. Multiply by 10h (very easy, just shift it left one place) to get 300h. Hence 0010:0310 is an equivalent address.

WHERE YOUR KEYSTROKES GO

As I mentioned at the outset, processes connected with interrupt 9 put keystrokes into a memory buffer, and processes connected with interrupt 16 get them out. Now that we know where to find it, it's time to look at what goes on in the buffer, which, although the middle one, is the simplest element in the chain.

As shown in Figure 1, the first 400h (1,024 decimal) bytes in memory, from address 0000:0000 to 0000:03FF, are used by the CPU to store an interrupt vector table, which we'll discuss later on. Immediately above this (using equivalent addressing), the area from 0040:0000 to 0040:00FF is used by the BIOS—the low-level Basic Input/Output System—to store

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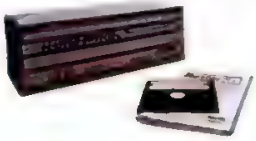

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data, including input from the keyboard. These 256 (decimal) memory bytes are known as the BIOS data area or the BIOS communication area. The last 16 bytes of the BIOS data area, called the Interprocess Communication Area, are intended to be used by programs to exchange data. In fact, this area is used only rarely, in part because there's no way to ensure that a third program won't overwrite what a first program places there for a second program.

To demonstrate just how keyboard information is stored in the BIOS data area, I've written a simple Turbo Pascal program, BIOSDATA.EXE, which you can download from PC MagNet. (Note: Instructions for downloading programs from PC MagNet, including those referenced in this Lab Notes, are printed in the article on this issue's free utility, WINWHERE .EXE. Commented source code is provided with the download.) BIOSDATA loads and continually rereads and displays the memory region from 0040:0000 to 0040:00FF, which gives you a real-time

BIOSDATA.EXE explains how keyboard information is stored in the BIOS data area.

view of what is happening there. It also periodically reads the keyboard and exits when you hit Esc. The 256 bytes are displayed with the address at the extreme left, a hex display in the middle, and an ASCII display on the right, as seen in Figure 2. While it will be helpful to have the program actually on the screen as you read what follows, the discussion should be understandable without it.

Make sure CapsLock, NumLock, and ScrollLock are off and then load BIOSDATA. The first thing you'll notice is that two areas are obviously counting—the bytes at 0040:0040 and 0040:006C are changing rapidly with carryover to the neighboring bytes.

These have nothing to do with the keyboard, but, as you might guess, they are keeping time. Approximately 18.2 times a second, the computer's internal clock ticks, and special routines that change those bytes are run. The byte at address 0040:006C is counting the ticks since midnight; the other (at address 0040:0040) simply performs a countdown again and again, and is used with the mechanism that shuts off the disk drive motor.

Press and release the Right Shift key several times. You'll notice that the byte at address 0040:0017h changes back and forth from 0 to 1. Now try the same thing with Left Shift, then with the Ctrl key, and then with the Alt Key (use the left Ctrl and Alt if your machine has two of them). If you don't have BIOSDATA, what you would have seen is that they behaved just like Right Shift except that Left Shift showed a 2, Ctrl a 4, and Alt an 8. Now press Alt and Left Shift at the same time. You get 0A, which is decimal 10. That's exactly the sum of the Alt and Left Shift keys, that is, 8 + 2! The system stores the state of each shifting key independently in 4 of the bits of the byte at address 0040:0017.

If you now try turning CapsLock on and off, you'll notice two things. First, one of the bits in byte 0040:0018 tracks whether the CapsLock key is physically pressed down or not. Since this is a toggle rather than a shifting key, however, what's important is the CapsLock state. And whether CapsLock is on or off is kept in 0400:0017, the same byte that keeps track of the shifts. Thus all of the 8 bits in byte 0400:0017 are used: 4 for the four shifting keys and 4 for the CapsLock, NumLock, ScrollLock, and Insert toggles.

Four bits in the byte at 0040:0018 keep track of whether the toggle keys are depressed. For example, *XyWrite* can treat CapsLock as an extra shift by using this byte. The lower 4 bits on that byte go unused in the original PCs, XTs and early ATs. When the enhanced keyboard was introduced, however, these bits were put to use keeping track of the difference between the Left and Right Ctrl and Alt keys. If you have an enhanced keyboard and BIOSDATA, try experimenting with the left and right Alt keys while watching bytes 0040:0017 and 0040:0018.

Now, while watching the ASCII character display on the right of the screen, hit the 1 key on the top row repeatedly (or hold it down). You should see that the bytes in the addresses from 41Eh to 43Dh fill with alternating 1's and happy faces. This memory area is known as the keyboard buffer. If you look at BIOSDATA's hex display for this area, you'll see that 31h alternates with 02h. 31h is the ASCII code for the character 1; we'll see about the 02h's—the happy faces—shortly. Try hitting some other number or letter keys

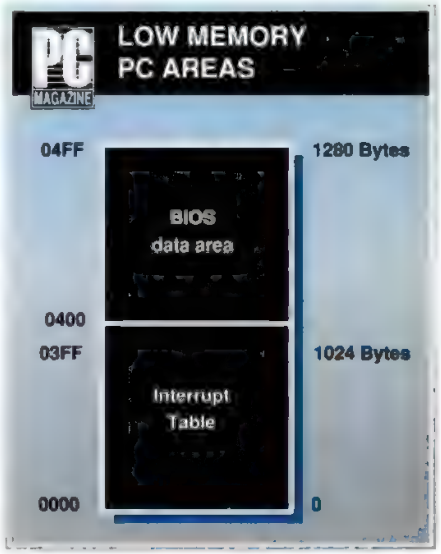

Figure 1: The low memory area from 40:0000 to 0040:00FF contains the keyboard buffer. This area is displayed in full by the BIOSDATA.EXE program.

while watching what happens in the ASCII representation of the keyboard buffer. You'll find that each keystroke sends a pair of bytes to that area, and that the one at the even address is shown on the ASCII display as the character you hit. I'll explain what happens to the odd bytes in a moment.

Next, try alternately hitting the top row Plus key and the gray Plus key. The ASCII part is, not surprisingly, a plus, mirrored by 2Bh's (the ASCII value of the plus sign) in the even addresses in the hex part of the display. But notice that the other half of what is placed in this area is different for the two keys. In the odd addresses, you'll see 0Dh's for the top row Plus key and 4Eh's for the gray Plus key. If you've ever wondered how programs can distinguish between the two plus keys, now you know.

We've determined so far that for each keystroke, 2 bytes are placed in the keyboard buffer, the 32-byte memory area from 0040:001E to 0040:003D. The even address byte gets an ASCII code. The odd address byte gets a code that can distinguish between similar keys. To confirm this, watch what happens when you push Ctrl-A, lowercase a, uppercase A, and Alt-

A. The results are shown below:

Key	ASCII	Scan Code
a	61h	1Eh
A	41h	1Eh
Ctrl-A	01h	1Eh
Alt-A	00h	1Eh

The 1Eh that goes into each of the odd address bytes is obviously connected with the A key on the keyboard. As indicated in the inset above, this is called the *scan code*. It is also sometimes called the *software scan code* in order to distinguish it from the hardware scan code which, as we'll see, is often, but not always, the same.

Looking at the middle column above, note that since Ctrl-A is an ASCII character (like the uppercase and lowercase letters themselves), it returns a genuine ASCII code. Alt-A doesn't have an ASCII analog, however, so it returns 00h—the NUL code. For keystrokes that produce a 00h for the ASCII code, the software scan code is sometimes called the extended ASCII code.

From this example, you might provisionally conclude that the scan code byte depends only on the key hit and that the ASCII code byte is used to distinguish among the shift states of that key. But if you now successively hit F1, Shift-F1, Ctrl-F1, and Alt-F1, you'll get the following results:

Key	ASCII	Scan Code
F1	00h	3Bh
Sft-F1	00h	54h
Ctrl-F1	00h	5Eh
Alt-F1	00h	68h

Since function keys do not have ASCII equivalents, their ASCII code should always be 00h, as it is. But, in order to distinguish between the shift states of the function keys, we must violate our new provisional rule that the code in the second half of the 2-byte combination depends only on the key hit, not on its shift state.

For the original PC keyboard the complete rule is this: In situations where the ASCII code distinguishes shift states (that is, where the ASCII codes are nonzero), the software scan code is the same as the hardware scan code (which we'll investigate shortly). For keys whose ASCII codes are all 0—which means the function keys and arrows—the scan code is the hardware scan code for the unshifted keys, a fixed but arbitrary convention for the shifted states.

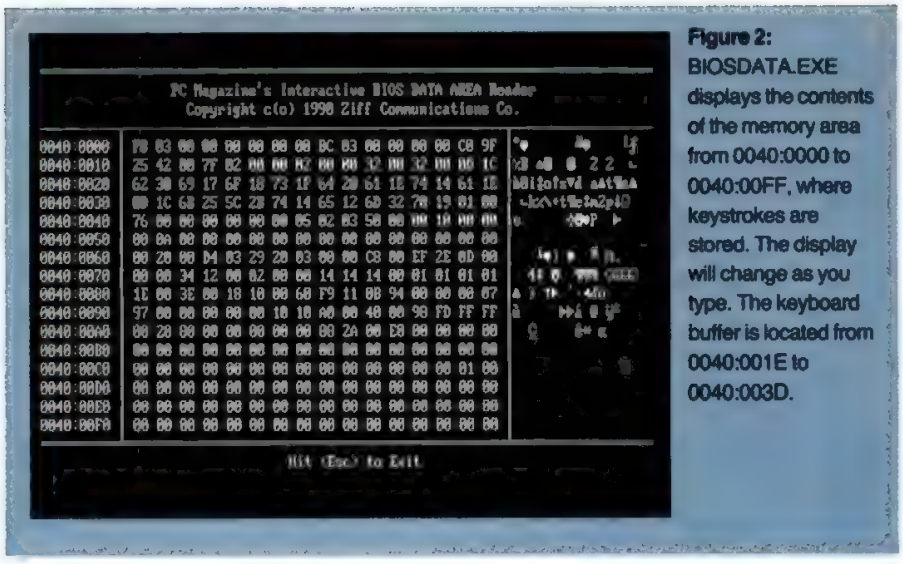

Figure 2: BIOSDATA.EXE displays the contents of the memory area from 0040:0000 to 0040:00FF, where keystrokes are stored. The display will change as you type. The keyboard buffer is located from 0040:001E to 0040:003D.

The enhanced keyboard adds a few extra complications. If you have one, try the two different Left Arrows; you'll find the following correspondence:

> On the original PC keyboard, when the ASCII codes are nonzero, the software and hardware scan codes are the same.

Key	ASCII	Scan Code
Left	00h	4Bh
Second Left	E0h	4Bh

Note that for the extra keys that were introduced with the enhanced keyboard, interrupt 9 places E0h in the ASCII part of the 2-byte sequence (since there is no key for which E0h is a valid ASCII value). While not many bother to do so, programs can thus distinguish the two Arrow keys on the enhanced keyboard.

GOING AROUND IN CIRCLES

While we've been watching the changes that take place in the keyboard buffer (the memory area from 0040:001E to 0040:003D), you may have noticed that as you hit various keys, the bytes at addresses 0040:001A and 0040:001C were also changing. One of these locations contain the address at which the next keystroke will be added (the tail). The other contains the address from which keystrokes will be removed (the head). BIOSDATA reads the keys as fast as they're entered, so the head keeps up with the tail.

The keyboard buffer is a queue, which is to say, keystrokes are added to the queue at the tail and removed at the head. The tail pointer is at 0040:001C, and 0040:001A is the head pointer. When these two pointers are equal, there are no keystrokes waiting in the buffer. If you've been typing various keystrokes into the buffer, why then does BIOSDATA always show the same values for 0040:001C and 0040:001A?

The reason is that the program is constantly on the lookout for an Esc, which means that you want to exit. It does this by checking for a keystroke before it updates the display. If there is a keystroke, it reads it from the keyboard buffer using INT 16h and exits if it is an Esc. As a result, it is taking keystrokes out of the buffer as fast as you can type them in. For this reason the head and tail of the buffer seem to be updated at the same time. Actually, on a slow machine (especially one with CGA where Turbo Pascal uses snow checking to slow the display), you will notice that 0040:001C gets ahead of 0040:001A, which then catches up when you take your hand from the keyboard.

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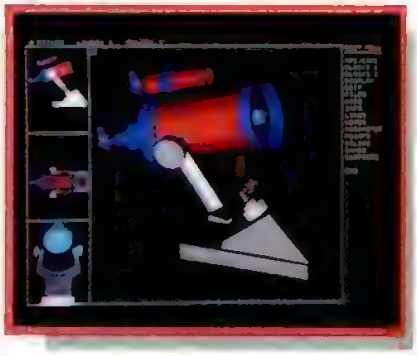

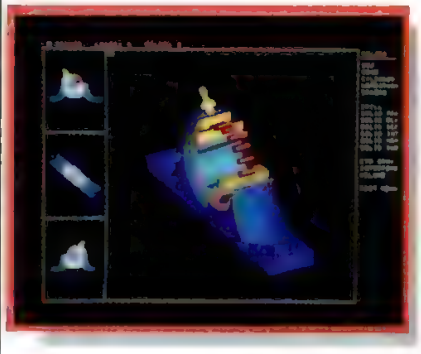

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The buffer is circular, so it loops around when the pointer reaches 0040:003D. If the last keystroke went into 0040:003C/0040:003D, the last byte in the buffer region, the next will go into 0040:001E/0040:001F, the first byte in the buffer.

Since it contains 32 bytes, you might think it would accommodate 16 keystrokes; for if the address of the head was fixed, there could be 16 possible places that the tail address can be. But since 0 strokes has to be a possibility, the 16 possibilities must be 0 . . . 15. Put differently, if one allowed 16 keystrokes, the tail would wrap around and catch up with the head, and there would be no way to distinguish an empty buffer and a full one!

This completes most of what I have to say about the BIOS data area. At this point, we haven't explained exactly how keystrokes get there, how programs get them out from there, and what programs like TSRs can do to modify the usual keyboard operations. We'll leave most of this for Part 2, but at this point we should take up the questions of what interrupts are in general and how they are generated by the keyboard hardware in particular. This will take us back to the lowest part of memory shown in Figure 1, the area from 0000:0000 to 0040:0000, and will also afford us a chance to explain the hardware scan codes that often end up in the odd-address bytes in the keyboard buffer.

INTERRUPTS AND SCAN CODES

The Intel 80x86 family is designed to use interrupts as the primary means by which both hardware and software communicate their needs to the microprocessor. Hardware interrupts ("true" interrupts by some programmers' reckoning) are prioritized by an interrupt controller chip on the motherboard before being passed on for CPU action. Thus, roughly 18.2 times a second, a clock chip stimulates the interrupt controller to cause the CPU to call interrupt 8 to update the time. And when you depress or release a key on the keyboard, the interrupt controller gets a signal and taps the CPU on the shoulder and tells it to call interrupt 9.

The alternative to an interrupt-driven system is to make the CPU continually run around to its various ports, polling each to see if one of them needs its attention. That's the only other way the CPU could learn that you've pressed a key. But periodically polling the keyboard port wastes a lot of CPU time—even when you're actively typing rather than looking at the screen. An interrupt system is like having students raise a hand if they have a question, as opposed to having the teacher call the class roll and ask each student if the point is clear.

When a program wants to read a keystroke from the buffer, it issues a software interrupt—specifically, interrupt 16. Applications also issue interrupts to call upon DOS services, such as reading from and writing to disk.

When an interrupt is called, either by hardware or software, a sequence of predetermined steps is executed. The routine that constitutes this sequence is called the interrupt handler. Whether this routine is actually located in the BIOS or elsewhere, a program must be able to access it by calling its interrupt number.

> If a program wants to read a keystroke from the buffer, it issues software interrupt 16.

That's where the first 400h (1,024 decimal) bytes of the PC's RAM memory come in. This area of memory is called the interrupt vector table, and it can hold 100h or 256 addresses in segment:offset form. (You'll recall that memory addresses in the DOS world consist of a 2-byte segment and a 2-byte offset, thus requiring 4 bytes per address.) As part of the bootup process, the built-in ROM BIOS and the hidden system files place the addresses of known interrupt handlers—including the default routines for keyboard interrupts 9 and 16—in this table. Thus, for example, if interrupt 16h is called, execution immediately jumps to the 4-byte address starting at 0000:0058. If a program wants to enhance the services provided by the default routines, there's a way (that we'll describe in Part 2) for it to do this.

In addition to stimulating the interrupt controller to issue an interrupt 9 request, each press or release of one of the keys on the keyboard creates a unique hardware scan code. That code appears at the keyboard port (60h), where it is read by the interrupt 9 BIOS code and translated into the 2-byte sequence that goes into the keyboard buffer.

On the original PC, the hardware scan code for a key release was exactly 80h higher than for the code for the press of that same key. For example, the scan code for the a key is 1Eh on depress and 9Eh on release. Until it resets the keyboard, whenever the CPU looks at port 60h, this hardware scan code will be returned to it. On the enhanced keyboard, there is a difference for the new keys that issue multiple scan codes; for example, Up Arrow on the cursor pad is E0+4B on depress and E0+CB on release—there is nothing added to the E0.

The hardware scan codes are just a sequential numbering of the keys as they were physically laid out on the original PC keyboard, starting with Esc at 01h, the 1 key at 02h, and so on. From the original keyboard's point of view, the Shift keys were no different from the other keys. Since the left Shift key was adjacent to the \ key, their scan codes became 2Ah and 2Bh, respectively. As the keyboard changed, the keys migrated but kept their scan codes, with the extra keys getting new codes.

So that you can see for yourself what the hardware scan codes are for each of the keys on your machine, I've written a program, INT9.EXE. The program returns the set of hardware scan codes called by the interrupt 9 routines. INT9.EXE required some inline code in order to put its own handler inside the normal interrupt 9 loop. This inline code was taken from Turbo Power Software's Turbo Professional and is used here with permission. Because of the number of scan codes that some of the enhanced combinations produce, the display can be somewhat confusing, so I have placed a blank line after every keyboard-release scan code that occurs with no other strokes stacked. Depending on exactly when the interrupt 9s are processed, however, this will sometimes cause some extra blank lines in the sequence of eight codes that are produced when you depress and then release a cursor key with NumLock on.

How you get from the scan codes at port 60h to the 2-byte sequences held in the keyboard buffer will be our starting point in Part 2. ■

Barry Simon is a contributing editor of PC Magazine.

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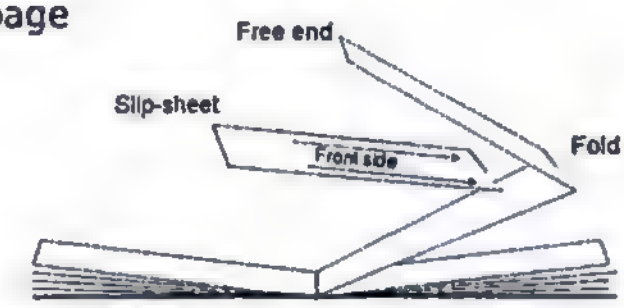

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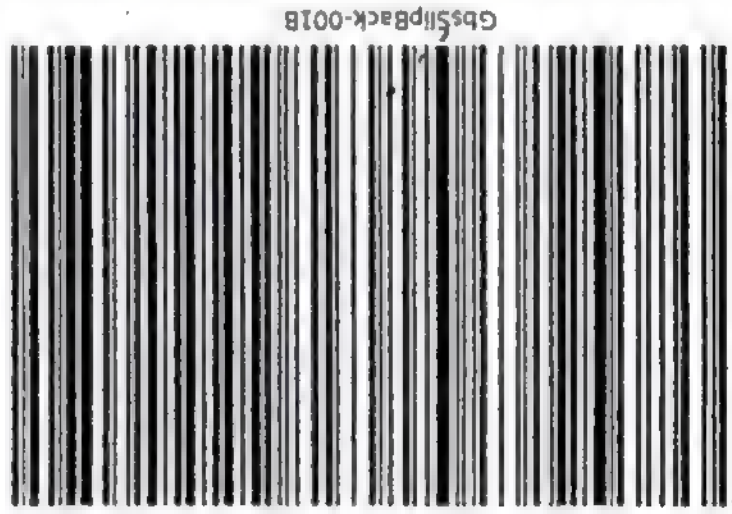

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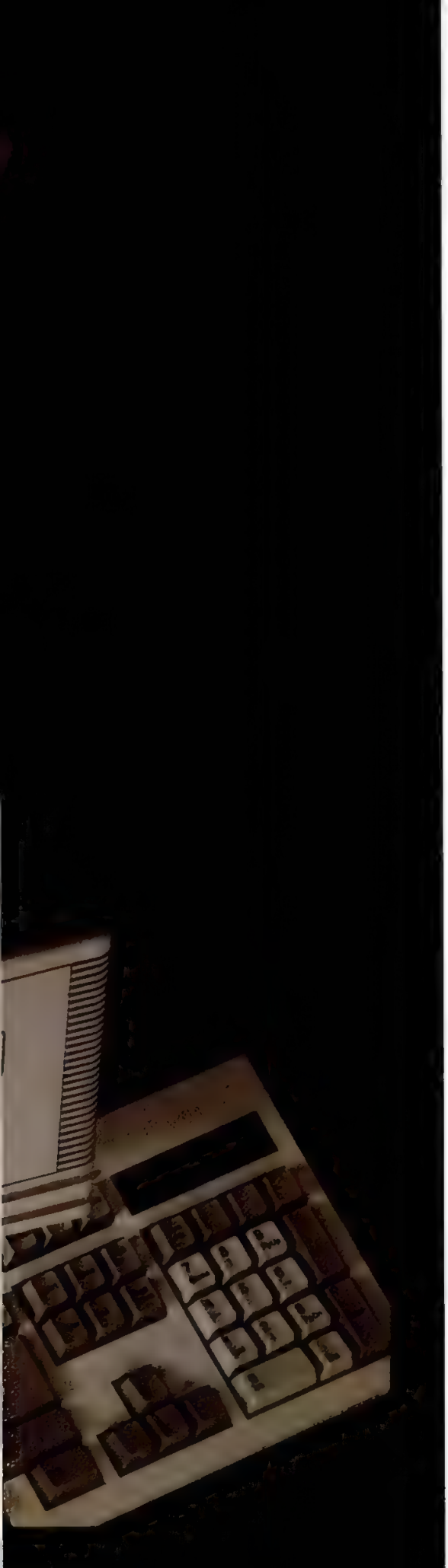
1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side



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by
Marc Adler

Utilities

Finding Your Files in Windows 3.0 with WINWHERE

Most likely you've already been delighted by the improvements Microsoft achieved by separating the Program Manager from the File Manager in *Windows* 3.0. You can now start a Program Manager application simply by double-clicking on its icon, and you can add, delete, or change the icons with ease. You can now organize the programs you frequently use into convenient groups, rather than having to weave your way through the disk directory structure to find them. You can even jump-start a data file whose extension is associated with a particular application in the [Extensions] section of WIN.INI.

But while the Program Manager now has a more object-oriented feel, the new File Manager—though an advance on the file management portion of the MS-DOS Executive—still looks like a *Windows*-ized version of a traditional DOS shell utility. One of its glaring deficiencies is that it lacks a file finder, the need for which became obvious during a recent visit to *PC Magazine*.

A large organization that uses *Windows* 3.0 may have many different servers on the network. Thus, in addition to his own physical and RAM drives, a typical user may have many different remote directories mapped into logical drives on his system. A *PC Magazine* staffer, for example, might have 20 different logical drives. How is he to find a particular file from within a *Windows* 3.0 session? There's no other way than to hand-navigate into each subdirectory of every logical drive on the system and perform a visual search for the desired file! WINWHERE, a file-finding utility written specifically for *Windows* 3.0, will eliminate this productivity roadblock.

WINWHERE lets you choose a file specification and select one or more drives to search. Your file specification can be either a complete filename or one containing the standard ? and * wildcards. You can limit the search by file date and size. All of the filenames that match your search criteria are displayed in a scrollable list box. As a bonus, WINWHERE gives you the option of automatically generating a batch file that contains a command for each file you select from the list box.

■ This handy *Windows* file finder eliminates the painful process of searching through individual drives and directories to locate the files you need.

You can download a ready-to-run copy of WINWHERE.EXE from PC MagNet. Simply follow the instructions given in the sidebar "WINWHERE by Modem."

If you wish to make modifications of your own to the program, you will also want to download the C source code and its associated files. In order to recompile the program, you will require the *Windows*, Version 3.0 Software Development Kit (SDK) and a C compiler capable of generating *Windows* code (Microsoft C 5.1 and later). You must make certain that the *Windows* INCLUDE files are stored in a directory specified by the INCLUDE environment variable. Also make sure that the *Windows* libraries are in a directory specified by the LIB environment variable. Then, using the MAKE.EXE utility that comes with Microsoft C 5.1, you are able to recompile simply by issuing the command

```
MAKE WINWHERE
```

USING WINWHERE

Once WINWHERE is on your disk, you'll want to add it to a Program Manager group. So start *Windows* and click the mouse on the program group into which you would like to put WINWHERE. (I chose the *Windows* Applications group on my system.) Select the File/New menu item from the main menu bar, enter the absolute pathname of WINWHERE, and press the OK button. The WINWHERE icon will be added to the program group, so you can run it simply by double-clicking the mouse on its icon.

WINWHERE has a leaner look than most *Windows* applications. In place of the usual main overlapped window and menu bar, WINWHERE brings up only a single main dialog box, shown in Figure 1. A program like WINWHERE doesn't need a lot of different commands, so there's no need for a menu bar. Since all user interaction is through the dialog box and nothing needs to be displayed on an encompassing frame window, there's no need for a main window either. You simply fill out the appropriate fields in the dialog box and click on the OK button.

Many users have a number of common file specifications they use repeatedly. For example, you might often wish to search simply for *PageMaker* or *XyWrite* files. To eliminate the need to re-enter such frequently used filespecs, WINWHERE provides a combination box that lets you list your file types and put their associated file specifications into the File Name field directly. The *.* file specification is associated with the default Anything file type,

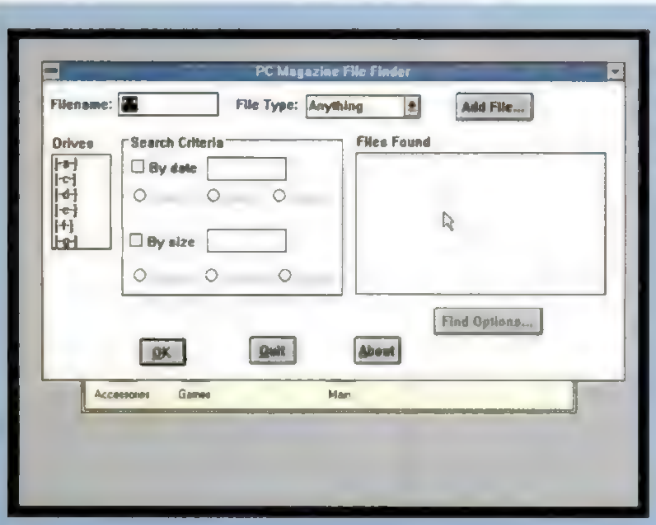

Figure 1: All desired file-search criteria are entered into appropriate fields of WINWHERE's main dialog box.

and you would want, for example, to associate the *.PM3 specification with your *PageMaker* files.

You can add identifying file types and their specifications to the combination box by clicking on the Add File push button. This brings up the dialog box shown in Figure 2. After entering the necessary information in the two edit fields, click the OK button and the file type will automatically be added to the combination box. The entire list of file type/specification pairs will be saved in the WIN.INI file when you exit, so WINWHERE will always come up with your custom set of file types.

Having entered or selected the desired file specification, you can then select one or more of the drives to be searched. All of the drives in your system, including logical network drives and RAM drives, are listed in a multiple-selection list box, so you simply click on the appropriate letter(s). The default, if you make no selection, is the current drive and directory with its subdirectories if there are any.

WINWHERE also lets you search for a file whose size is greater than, less than or equal to a specified number. Just click on the By Size check box, enter a size in the adjoining edit field (no commas or abbreviations are allowed), and click on one of the three radio buttons that designate the desired comparison. Note: The edit field and the radio buttons are disabled until the By Size check box is toggled On. A similar procedure lets you match files that were created (or last modified) later than, earlier than, or on the date you specify.

Once you have chosen the file specification, the disk drives to search through, and the other search criteria, all you need to do is push the OK button to commence the search operation. The complete pathnames of all the files that satisfy the criteria will appear in the Found Files list box. When the search operation has completed, you can then use the cursor keys or the mouse to read through the list of files.

As a final option, WINWHERE provides a way for you to generate a batch file that contains a single command for every file selected from those presented in the Found Files list box. You might, for example, want to copy some or all of the found files to a diskette. To do this, press the Find Options push button. A dialog box containing two edit fields and a multiple selection listbox will pop up. The edit fields prompt you for the filename you want to use for the batch file (remember to include the .BAT extension), and for the command to be given to each selected file. The multiple selection list box contains a copy of the entire list of found files. By default, all of the files in the list box are automatically selected. To deselect a file, simply click the mouse on the name of the file.

In entering the command string(s) that will constitute the batch file, you must use an exclamation point where the filename should be substituted. For example, to enter the command to copy a file to the A: drive, you would enter the string

```
copy ! a:
```

If you had selected the files LETTER.PM3, RECIPE.PM3, and FOOBAZ.DOC, the batch file generated by WINWHERE would then consist of the following lines:

```
copy LETTER.PM3 a:
copy RECIPE.PM3 a:
copy FOOBAZ.DOC a:
```

You can also navigate WINWHERE using the keyboard. Pressing Tab will move you clockwise from field to field, and Shft-Tab moves you counter-clockwise. To make a selection in a list box (for example, the drive list box), simply hit the Spacebar. Once you enter information in a field or make a selection, press Tab to move to the next field; pressing Enter will execute the search. Once you've specified your search criteria, Tab to the OK button and press Enter.

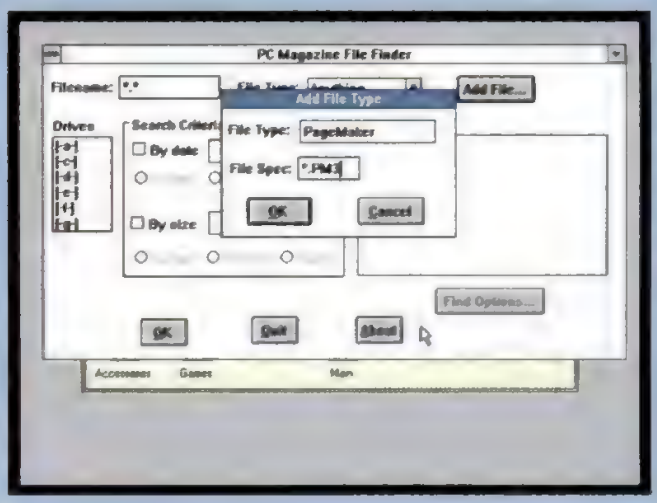

Figure 2: Clicking WINWHERE's Add File push button brings up a second dialog box, in which you can enter the file type and associated file specification for frequently needed file searches.

That's all there is to using WINWHERE! Now let's examine some inner workings of the program and see how to code this for a *Windows* environment.

UNDERSTANDING WINWHERE

When writing *Windows* programs in C, the entry point is a user-written function called WinMain(). Most *Windows* programs begin execution by registering the various window classes for all of the windows the application uses, including the class for the main window. The application then normally creates and displays the main window, after which it goes into the standard *Windows* message-processing loop.

WINWHERE does none of this. Instead, it directly loads the main dialog box from the binary resource information tacked onto the end of every *Windows* application's .EXE file. It does this by calling the DialogBox() function. DialogBox() will load and display the dialog box and will then go into an internal message-processing loop that monitors all messages sent to the dialog box.

The DialogBox() function creates a modal dialog box. With a modal dialog box, the user must explicitly dismiss the dialog box before interacting with any other window in the application. The user can dismiss a modal dialog box by clicking the mouse on the OK or CANCEL push button. A less frequently encountered type of dialog box is the modeless dialog box. With a modeless dialog box, the user can switch the input focus between the dialog box and another window in the application at any time. The PIF editor window in *Windows* is a modeless dialog box.

WINWHERE lets you search for a file whose size is greater than, less than, or equal to a specified number.

Every dialog box must call a function that handles the message flow from *Windows* to the dialog box. This function allows the *Windows* application to process these messages before the dialog box manager does. Figure 3 shows a diagram of the processing that surrounds a modal dialog box. The dialog box function for WINWHERE's main dialog box is called WhereDlgProc(), and it looks *almost* like a normal window procedure. Notice, however, that a dialog box function must return a 1-byte BOOL value rather than the 4-byte LONG value returned by a window procedure. The dialog box function returns TRUE if it processes the message itself; it returns FALSE if the dialog box manager should process the message instead.

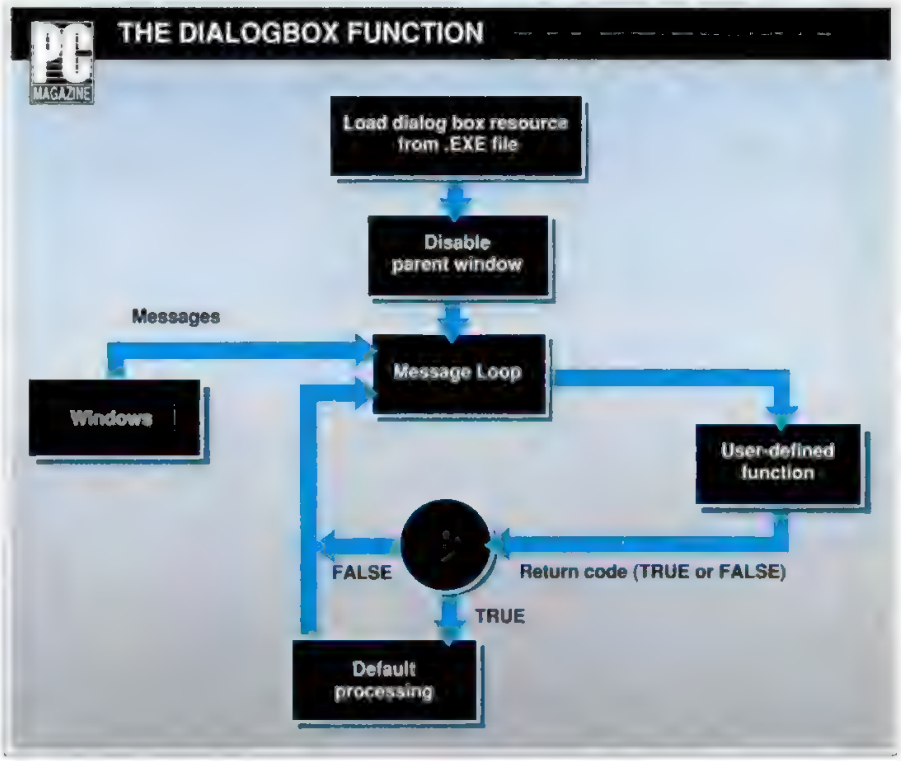

Figure 3: Every dialog box must call a function that handles the message flow from *Windows* to the dialog box itself. This diagram illustrates the processing that surrounds the Modal dialog box.

The first message always sent by *Windows* to a dialog box is the WM_INITDIALOG message. It gives the programmer the chance to initialize the various controls in the dialog box before the dialog box is actually displayed. Since you can minimize WINWHERE's main dialog box, we first want to associate an icon with it.

When a window is minimized, *Windows* hides the window itself and displays an icon in its place. The icon to be displayed is usually associated with a window class when the programmer registers the class. (The programmer loads the icon into the program and obtains a handle to the icon. The handle is then placed into the WNDCLASS structure that is used when registering a window class.) But since there is no class registration code in WINWHERE, how do we associate an icon with the dialog box? How does the WINWHERE dialog box come to belong to a window class?

Windows predefines a window class to which most dialog boxes belong. You can verify this by using the SPY program that comes with the *Windows* SDK to examine the structure of a typical dialog box. The single line of code that associates an icon with the dialog box is

```
SetClassWord(hDlg, GCW_HICON,
 LoadIcon(hInst, "WinWhere"));
```

We use LoadIcon() to load the specified icon from the .EXE file. This function returns the handle of the loaded icon. To place the handle of the icon into the window class data structure, we then call SetClassWord() with GCW_HICON as the second argument and the handle of the loaded icon as the third argument. The line of code above will associate the loaded icon with every dialog box WINWHERE creates. This may not be the ideal procedure, but since WINWHERE uses only one minimizable dialog box, we can get away with it.

A second task to be performed during the dialog box initialization process is loading the string containing your customized list of file-type/file-specification pairings. These are stored as one long string in the WIN.INI file, as typified by the four pairings in the line that follows:

```
[WinWhere] FileTypes = Anything
 *.* Document *.doc Pagemaker
 *.pm3 XYWrite *.xyw
```

We can load this string from the WIN .INI file by using the *Windows* function GetProfileString(). When you start WINWHERE for the very first time, only the Anything *.* pairing is placed into the combination box. It's up to you to add more entries of your own.

The current implementation of WINWHERE cannot delete or edit a file-type/file-specification pairing once stored. You can do this yourself, however, by using an ordinary ASCII text editor to edit the WIN .INI file. Simply search for the [WinWhere] section and edit the specification string yourself. Remember to leave a blank between a file type and the corresponding specification. Indeed, you could edit the WIN.INI file from within *Windows* by using the SYSEDIT program that comes with *Windows*. (Note that *Windows* does not preinstall the SYSEDIT program in the Program Manager when you first install *Windows*. You can, however, use the File/New menu choice to install it yourself into one of the program groups.)

The final thing we must do in the initialization code is to get the names of all of the disk drives in the system and insert them in the Drive list box. This is done by sending the LB_DIR message to the Drive list box, using a suitable value for the wParam parameter:

```
SendDlgItemMessage(hDlg,
 ID_DRIVELIST, LB_DIR, 0xC000,
 (LONG) (LPSTR) "---.---");
```

The 0xC000 is the value of wParam, and informs *Windows* that we want an exclusive search for all drives. Unfortunately, left to its own devices, *Windows* will automatically search for all normal files as well as the drives and will thus put the name of each file found in the list box. Since we obviously don't want filenames in the Drive list box, we deceive *Windows* by setting the lParam value to the search specification of ---.---. Since the odds are that your system does not have a file called ---.---, *Windows* won't find any files with that name, and the only thing it will put into the Drive list box will be the drive names themselves.

After WhereDlgProc() processes the WM_INITDIALOG message, control is returned to *Windows*' internal dialog box manager, which then displays the dialog box. The only other message to which we must react is the WM_COMMAND message. This message is sent to WhereDlgProc() whenever an event of interest happens to one of the dialog box controls. When a WM_COMMAND message is sent, the wParam value contains the identifier of the control in which the event occurred, and the HIWORD of lParam contains a certain notification code. In WINWHERE's case, we must take some kind of action when any one of the five

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To download WINWHERE.EXE, its C source code, and associated Make files, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, and then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

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LITES.COM, Version 1.1
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PCMANAGE.EXE, Version 1.1
RN.COM, Version 2.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT .ARC.

A downloadable index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that contains *Computer Library*'s *PC Magazine* Reviews Index for January 1988 to June 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files. ■

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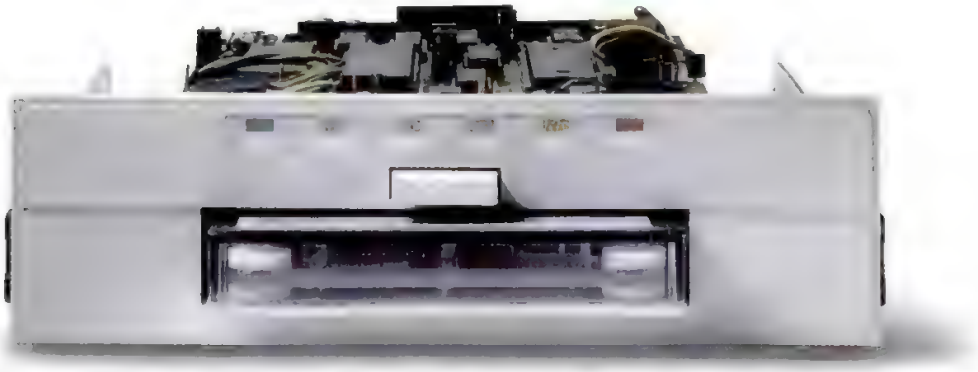

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CIRCLE 107 ON READER SERVICE CARD

BEFORE

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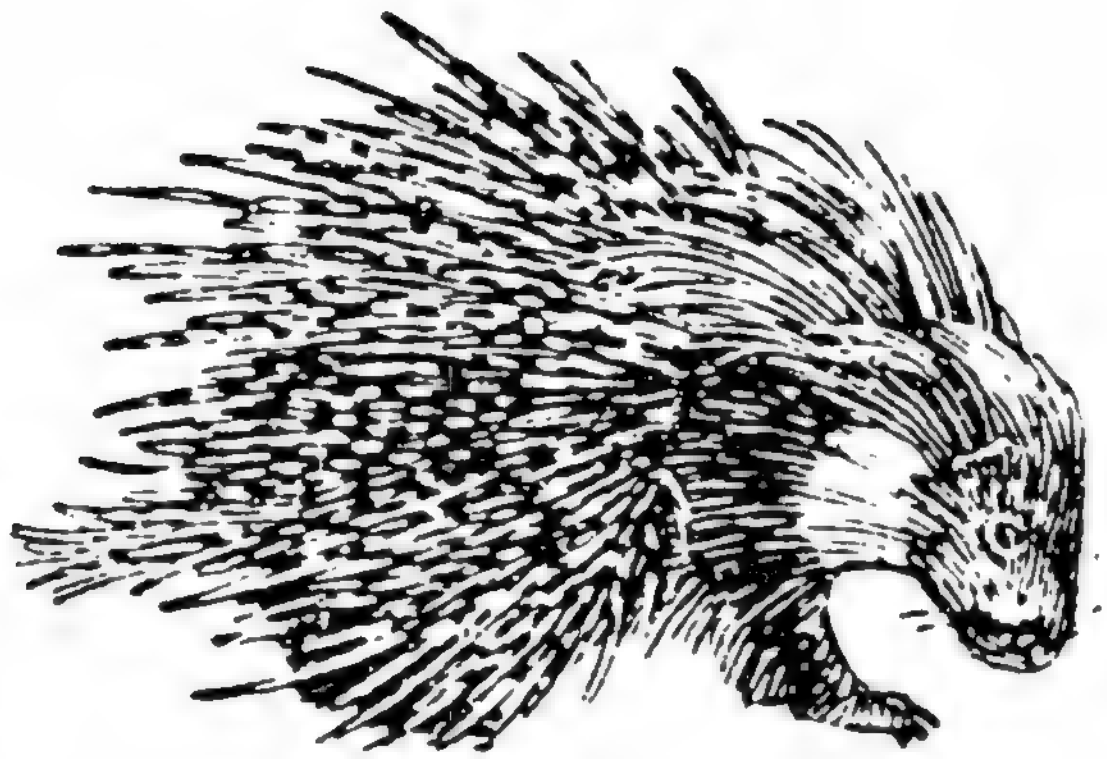

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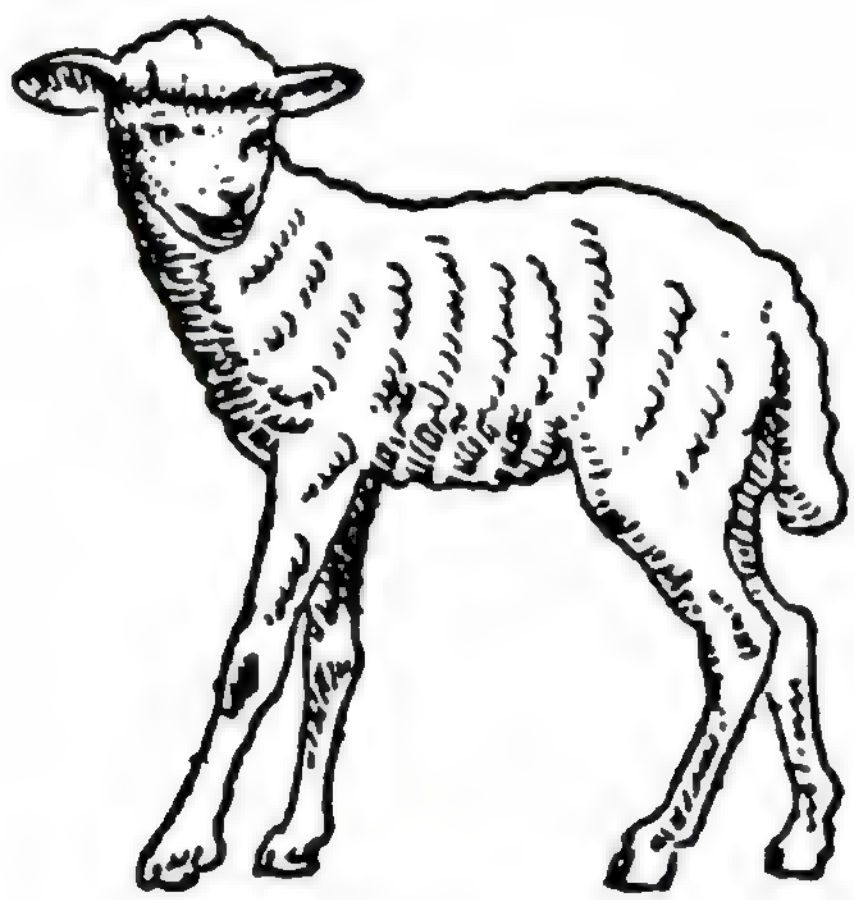

AFTER

CIRCLE 131 ON READER SERVICE CARD

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push buttons is clicked, when the By Size and the By Date check boxes are clicked, and when you select an entry from the File Type combination box.

When the By Size or By Date check box is not checked, we should disable the edit control and the three radio buttons of that control group. This prevents you from entering data in the edit field and from using the mouse or keyboard to select a radio button. Moreover, the input focus cannot be set to a disabled control. However, when you check one of these check boxes, the controls in that control group should all be enabled so that he can enter data in the edit field and select one of the radio buttons.

To enable and disable a window, we use the EnableWindow() function. The second argument to this function is a Boolean value that is nonzero if the window is to be enabled and zero if the window is to be disabled. The code to accomplish this is shown in section [A] of Figure 4.

When an item is selected from a combination box, the WM_COMMAND message is sent to WhereDlgProc() with the HIWORD of the lParam value set to the CBN_SELCHANGE notification code. This message is useful to process if another control tracks the current selection in a list box or in a combination box. In this application, when the currently selected file type in the combination box changes, we must change the contents of the File Name edit control to reflect the corresponding file specification. The relevant code is shown in section [B] of Figure 4.

The main processing in WhereDlgProc() is triggered when you click on the OK push button. At this point, we must scan all of the control windows in the dialog box and derive the search criteria—the file specification, the drives to search through, and the optional date and size values. We then call the WhereDriver() function to start the search operation.

WhereDriver() clears the previous contents of the Found Files list box and turns off its redraw flag. If this flag were left on, each successive string added to the list box would cause a complete redisplay of the list box. So, we turn the redraw flag back on after the search process is finished.

Since the search operation may take some time, it's best to give you the customary visible clue by changing the shape of the *Windows* mouse pointer from an arrow to an hourglass. To change the cursor shape to an hourglass and back we use the calls shown in Figure 4[C].

FindFilesInDirectory() is the function that contains the actual search logic. It relies heavily on the information returned by the `_dos_findfirst()` and the `_dos_findnext()` functions. These two functions are Microsoft's C language interface to MS-DOS's Interrupt 21h, functions 4E and 4F. To search for a group of files that match a certain specification, you must first call the `_dos_findfirst()` function. You pass `_dos_findfirst()` the file specification string, the attribute bits that the files must possess, and a pointer to a `find_t` structure. The fields in the `find_t` structure and the attribute values are shown in Figure 5. If `_dos_findfirst()` finds a file that matches the specification and has the desired attributes, it returns the value 0 to the program. The `find_t` structure is then also filled in with information about that file. After processing the first hit, `_dos_findnext()` is then called in a loop to search for more files. The loop should be terminated when `_dos_findnext()` returns a nonzero value. Note that `_dos_findnext()` also fills the `find_t` structure with information about the found files.

WINWHERE tells `_dos_findfirst()` and `_dos_findnext()` to find all normal files, that is, files that have no attributes (neither the Archive bit nor the Read-Only bit is set) but that match the desired file specification. If you have added size or date limitations to the search, the size or date fields of the `find_t` structure are compared with the values you requested. If the search criteria are satisfied, the name of the file is added to the Found Files list box.

WINWHERE.C — **CODE EXCERPTS**

```
[A]
case ID_BYSIZE  :
   if (IsDlgButtonChecked(hDlg, ID_BYSIZE))
   {
     EnableWindow(GetDlgItem(hDlg, ID_SIZE), TRUE);
         ......
   }
   else
   {
     EnableWindow(GetDlgItem(hDlg, ID_SIZE), FALSE);
         ......
   }
   break;


[B]
case ID_FILETYPE:
   switch (HIWORD(lParam))
   {
     case CBN_SELCHANGE :
       /*
         When the current selection in the file-type combo box
         changes, we extract the file spec and put it into
         the edit field.
       */
       iCurrFileType = (int)
         SendDlgItemMessage(hDlg, ID_FILETYPE, CB_GETCURSEL, 0, 0L);
       SetDlgItemText(hDlg, ID_FILENAME,
                      FileTypeInfo[iCurrFileType].szSpec);
       SendDlgItemMessage(hDlg, ID_FILENAME, EM_SETSEL,
                          NULL, MAKELONG(0, 0x7FFF));
       break;


[C]
HCURSOR hOldCursor;

hOldCursor = SetCursor(LoadCursor(NULL, IDC_WAIT));
/*
  Do the long operation....
*/
SetCursor(hOldCursor);
```

Figure 4: The first code excerpt above is the second argument to the EnableWindow() function, which you use to enable and disable a window. The second extracts the file specification and puts it into the edit field when the current selection in the file-type combination box changes. The last shows the calls used to change the cursor to an hourglass and back while a search is in progress. All three excerpts are from the source code file, WINWHERE.C.

RESULTS FROM _DOS_FINDFIRST() AND _DOS_FINDNEXT()

```
struct find_t
{
     char reserved[21];  /* not used */
     char attrib;        /* attribute - see table below */
     unsigned wr_time;   /* time the file was last written */
     unsigned wr_date;   /* date the file was last written */
     long size;          /* the size of the file in bytes */
     char name[13];      /* the name of the file */
};

/* File attribute constants */
#define _A_NORMAL   0x00 /* Normal file - No*/
                         /* read/write restrictions*/
#define _A_RDONLY   0x01 /* Read only file */
#define _A_HIDDEN   0x02 /* Hidden file */
#define _A_SYSTEM   0x04 /* System file */
#define _A_VOLID    0x08 /* Volume ID file */
#define _A_SUBDIR   0x10 /* Subdirectory */
#define _A_ARCH     0x20 /* Archive file */
```

Figure 5: This code excerpt shows the file information returned by _dos_findfirst () and _dos_findnext () via the fields in the find_t structure and the attribute values.

After the first-round search for normal files, the `_dos_findfirst()` and `_dos_findnext()` functions are called again, this time to locate matching files in all of the subdirectories contained under the current directory. FindFilesInDirectory() is called recursively for each such subdirectory, if any.

When the entire searching operation is done, we restore the original mouse pointer, reenable the OK push button, and turn the redraw flag for the Found Files list box back on. You can read this list box and then generate a batch file that contains a command for files in the list.

ENHANCEMENTS

I think you'll find that WINWHERE is a powerful tool that will greatly enhance your *Windows* environment—especially if you're the kind of user who likes to stay in *Windows* all day long. At first glance, I don't see much that you're likely to want to add to WINWHERE—but I also know that user ingenuity is boundless, so feel free to "max it out" with more features. You may want to enhance the search criteria with a choice of DOS file attributes (to find all hidden and system files, for example), and file time (for example, to find all files modified in the past hour). You might also add a second value to the date and the size criteria so that you could define a lower and upper limit to the range of search values (to find all files between 1,000 and 2,000 bytes in size, for example). But these are exercises left for the reader! ■

Marc Adler heads Magma Software Systems of Milburn, New Jersey. He is also the developer of MEWEL Window System.

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PC MagNet News

The Latest Files and Features of PC Magazine's On-line Service

Michael Dell To Host First Guest Forum

The topic will be computers—from laptops to servers—in the second week of December, when Michael Dell, president of Dell Computer Corp., hosts a special guest forum on PC MagNet.

Dell has already been a frequent visitor to the magazine's editorial forum. From December 8 to 15, you'll be able to find him quickly and easily by typing "GO DELL" anywhere in PC MagNet.

There's no limit on where the discussion will lead. Questions on computer design, grumbles about your computer, and suggestions for new directions will be fair game.

Of course, MagNet regulars Bill Machrone, John C. Dvorak, and William F. Zachmann will be checking in as usual. Whether you have something to say or just want to read what's been said, give "GO DELL" a try.

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Regular PC MagNet users have started enjoying an easy way to catch up with articles on anything from international finance to audio equipment.

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LIST 7.5e Adds Auto-Dialer and Archive Viewers

LIST is one of PC MagNet's many highly regarded, user-supported DOS utilities. It's a general-purpose file viewing and browsing utility—and much more. Brand new features in the latest version include a file selection menu, a telephone dialer, bookmarks, and the ability to view files that are stored in archives.

The new version of LIST—Version 7.5e—is file LIST75.ARC in our Utilforum/Tips Forum in PC MagNet's Lib 2 (the Utilities library). If you enjoy LIST, be sure to thank the author, Vern Buerg, who drops by MagNet's forums from time to time. Vern's a sysop on CompuServe's IBMSYS forum, where you can find him and the latest version of LIST.

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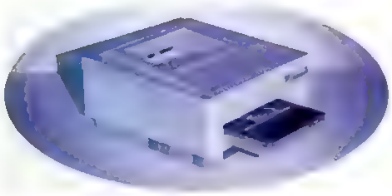

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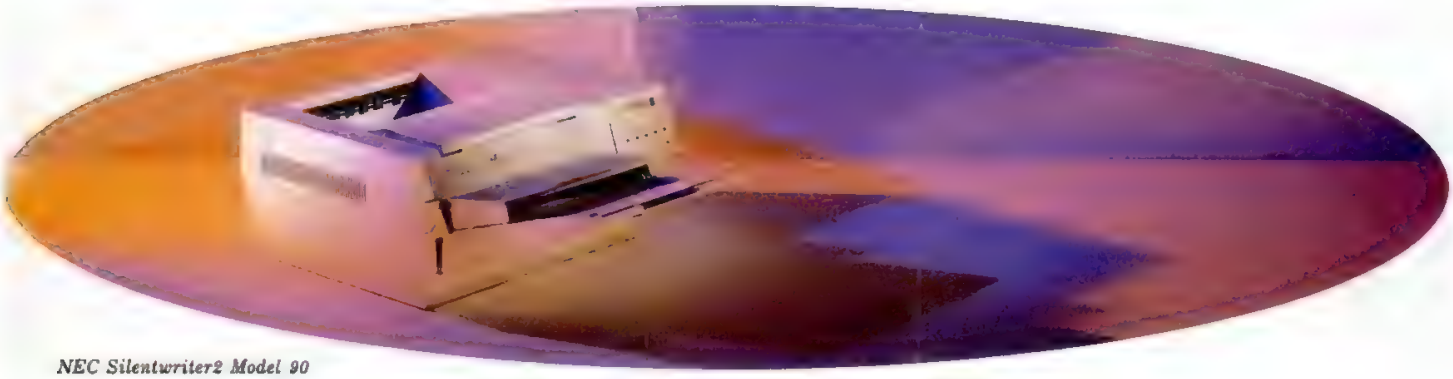

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PC MAGAZINE EDITORS' CHOICE
November 13, 1990
SilentWriter2 Model 90

CIRCLE 375 ON READER SERVICE CARD

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by
Charles Petzold

Environments

Working with Color: Exploring the GPI Color Functions

■ Here's a look at how color is handled in OS/2's Graphics Programming Interface.

In the last issue, I discussed some traditional representations of color and how common video adapters and monitors implement color. In this column, we'll begin exploring the GPI color functions. These functions are obviously at a much higher level than the video board hardware, but as we'll find, the hardware cannot always be ignored.

THE BASIC GPI COLOR FUNCTIONS

When programming for the OS/2 Presentation Manager, you normally specify a color using the GpiSetColor function:

```
GpiSetColor (hps, lIndex) ;
```

As is the case with most GPI functions, the first parameter is a handle to a presentation space. The second parameter is a color index.

The GpiSetColor function sets the color for all subsequently drawn graphics primitives. There are five GPI graphics primitives, including lines, filled areas, text markers (which are generally small symbols), and images (which are similar to bitmaps).

Four of these primitives (filled areas, text, markers, and images) have background areas. The background color is set using

```
GpiSetBackColor (hps, lIndex) ;
```

The foreground and background colors are attributes of the presentation space. A program obtains the current color indexes for the foreground and background colors by calling

```
lIndex = GpiQueryColor (hps) ;
```

and

```
lIndex = GpiQueryBackColor (hps) ;
```

A PM program can set different colors for each of the five graphics primitives by calling GpiSetAttrs, and query these attributes by calling GpiQueryAttrs.

THE COLOR INDEXES

The *lIndex* parameter to the GpiSetColor and GpiSetBackColor functions is normally one of the constants defined in PMGPI.H beginning with the prefix CLR. These constants are known as *color indexes*, and are shown in Figure 1.

With a few exceptions, these constants are fairly self-explanatory. CLR_BACKGROUND—the default background color—is the window background color you set in the PM Control Panel. The default is white. The default foreground color is CLR_NEUTRAL, which is the window text color you set in the Control Panel—black by default.

The CLR_DEFAULT parameter normally sets the foreground color to CLR_NEUTRAL when used with GpiSetColor and the background color CLR_BACKGROUND when used with GpiSetBackColor. However, beginning with OS/2 1.2, you can change this using the GpiSetDefAttrs function.

CLR_FALSE corresponds to black on black-background devices such as video displays and white on white-background devices such as printers. Similarly, CLR_TRUE corresponds to white on black-background devices and black on white-background devices.

I mentioned in the last issue that the IRGB (Intensity-Red-Green-Blue) color encoding first used on the IBM CGA for character mode continues to play a big role in PM graphics programming. You'll note that these color indexes correspond to the 16 colors available with IRGB color encoding. The only difference is terminology: IBM documentation for the CGA uses *magenta* where the GPI constants use *pink*. And IBM CGA documentation distinguishes between normal colors and

GPI'S COLOR INDEXES

```
#define CLR_BACKGROUND     0L
#define CLR_BLUE           1L
#define CLR_RED            2L
#define CLR_PINK           3L
#define CLR_GREEN          4L
#define CLR_CYAN           5L
#define CLR_YELLOW         6L
#define CLR_NEUTRAL        7L
#define CLR_DARKGRAY       8L
#define CLR_DARKBLUE       9L
#define CLR_DARKRED        10L
#define CLR_DARKPINK       11L
#define CLR_DARKGREEN      12L
#define CLR_DARKCYAN       13L
#define CLR_BROWN          14L
#define CLR_PALEGRAY       15L
#define CLR_BLACK          (-1L)
#define CLR_WHITE          (-2L)
#define CLR_DEFAULT        (-3L)
#define CLR_TRUE           (-4L)
#define CLR_FALSE          (-5L)
```

Figure 1: These are the color indexes as defined in the PMGPI.H header file.

light colors; GPI distinguishes between normal colors and *dark* colors.

THE RGB COLOR REPRESENTATION

Before further exploring the GPI color functions, we need to look at the way GPI refers to real colors internally.

In the last issue, I discussed one common approach to quantifying color, using red, green, and blue additive primaries. In GPI, you specify an RGB color value with a 32-bit integer encoded as follows:

```
-----------------------------------
00000000|    Red    |  Green  |  Blue
-----------------------------------
```

The high 8 bits are set to 0. Each of the red, green, and blue values can range from 0 through 255. This encoding scheme can represent some 16 million colors (2^{24}). It's widely believed that this exceeds the human eye's ability to differentiate color. Indeed, color video displays in use today are limited to about 6 bits of resolution for each primary.

Is it overkill? Do we need so many colors? Can we make do with fewer? I don't think so. We probably want 256 shades of gray. And because gray shades occur when red, green, and blue values are equal, this implies the red, green, and blue values must also range from 0 to 255.

Two structures in the PM header files define RGB color values. The first dates from OS/2 1.1:

```
typedef struct _RGB
  {
    BYTE bBlue ;
    BYTE bGreen ;
    BYTE bRed ;
  }
    RGB ;
```

The second is new with OS/2 2.0:

```
typedef struct _RGB2
  {
    BYTE bBlue ;
    BYTE bGreen ;
    BYTE bRed ;
    BYTE fcOptions ;
  }
    RGB2 ;
```

These two structures are used mostly with bitmaps (a subject I'll return to after this series on color). However, you can convert an RGB2 structure to a 32-bit long integer and vice versa. For example, suppose you define the following:

```
LONG lRgbColor ;
RGB2 rgb ;
```

Suppose also that you define the bBlue, bGreen, and bRed fields of the RGB2 structure and set fcOptions to 0. You can move that information into the 32-bit LONG using

```
lRgbColor = * (LONG *) &rgb ;
```

If you have a 32-bit LONG that represents an RGB color value, you can move that information into an RGB2 structure:

```
rgb = * (RGB2 *) lRgbColor ;
```

> In GPI, you specify an RGB color with a 32-bit integer, encoded so it can represent 16 million colors.

THE COLOR TABLES

In this column and the next, I'll discuss color tables. There are two of them, and it's important to keep them distinct in your mind. Both of these color tables are maintained by the presentation driver (also called the device driver) for the graphics output device. The presentation driver for the video display is the dynamic link library DISPLAY.DRV.

The *logical color table* determines how the color indexes passed to the GpiSetColor and GpiSetBackColor functions correspond to 24-bit RGB color values. We'll look at the logical color table in the next section, but I'll cover it in greater detail in next issue's column.

The *physical color table* is the total array of RGB color values that can currently be rendered on the output device. The physical color table corresponds to the values that the presentation driver loads into the palette registers of the video adapter board.

As I discussed in the last issue, a pixel is stored in video adapter memory as multiple bits to represent color. I call these the *pixel bits*. The number of bits used for each pixel determines the number of colors than can be displayed simultaneously. Four bits per pixel allow 16 simultaneous colors, with values ranging from 0 through F. Eight bits per pixel allow 256 simultaneous colors. The pixel-bit values range from 00 through FF. (Don't confuse the pixel-bit values with the color indexes in Figure 1. They are completely different. The color indexes map to an RGB color value as determined by the logical color table. The presentation driver must find the pixel-bit value that corresponds to this RGB color value that's loaded into the palette table of the video adapter board. The presentation driver uses the pixel-bit value for writing to video display memory.)

The ordering of the physical color table is based on increasing pixel-bit values beginning with 0. Thus, the physical color table is essentially the hardware palette table.

There is one more type of color table, known as the *realizable logical color table*, which, for the sake of completeness, I'll discuss in the next issue. It's not implemented in OS/2 1.2 and will probably be obsolete with OS/2 2.0.

INDEXES AND RGB COLORS

The color indexes shown in Figure 1 are mapped to 24-bit RGB colors within the GPI presentation driver for the graphics output device. This mapping is known as the logical color table. Even without obtaining the complete logical color table, you can obtain the RGB color corresponding to a particular color index by calling

```
lRgbColor = GpiQueryRGBColor (hps,
  flOption, lIndex) ;
```

The color index is the last parameter. The flOption parameter may be either 0L or LCOLOPT_REALIZED. The LCOLOPT prefix stands for logical color option. This parameter involves realizable logical color tables.

You can also do the opposite—obtain a color index from an RGB color value:

```
lIndex = GpiQueryColorIndex (hps,
  flOption, lRgbColor) ;
```

Again, flOption may be either 0L or

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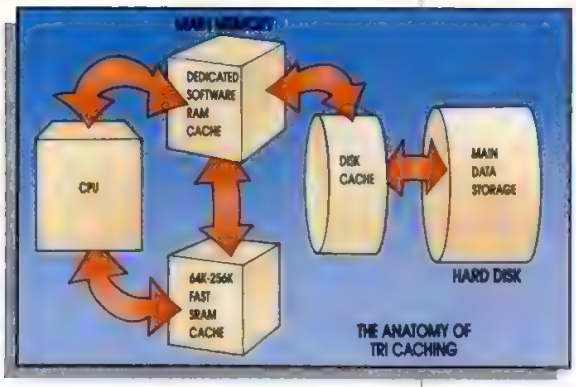

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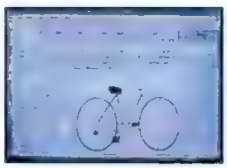

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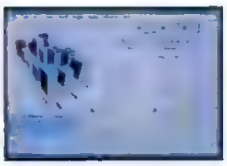

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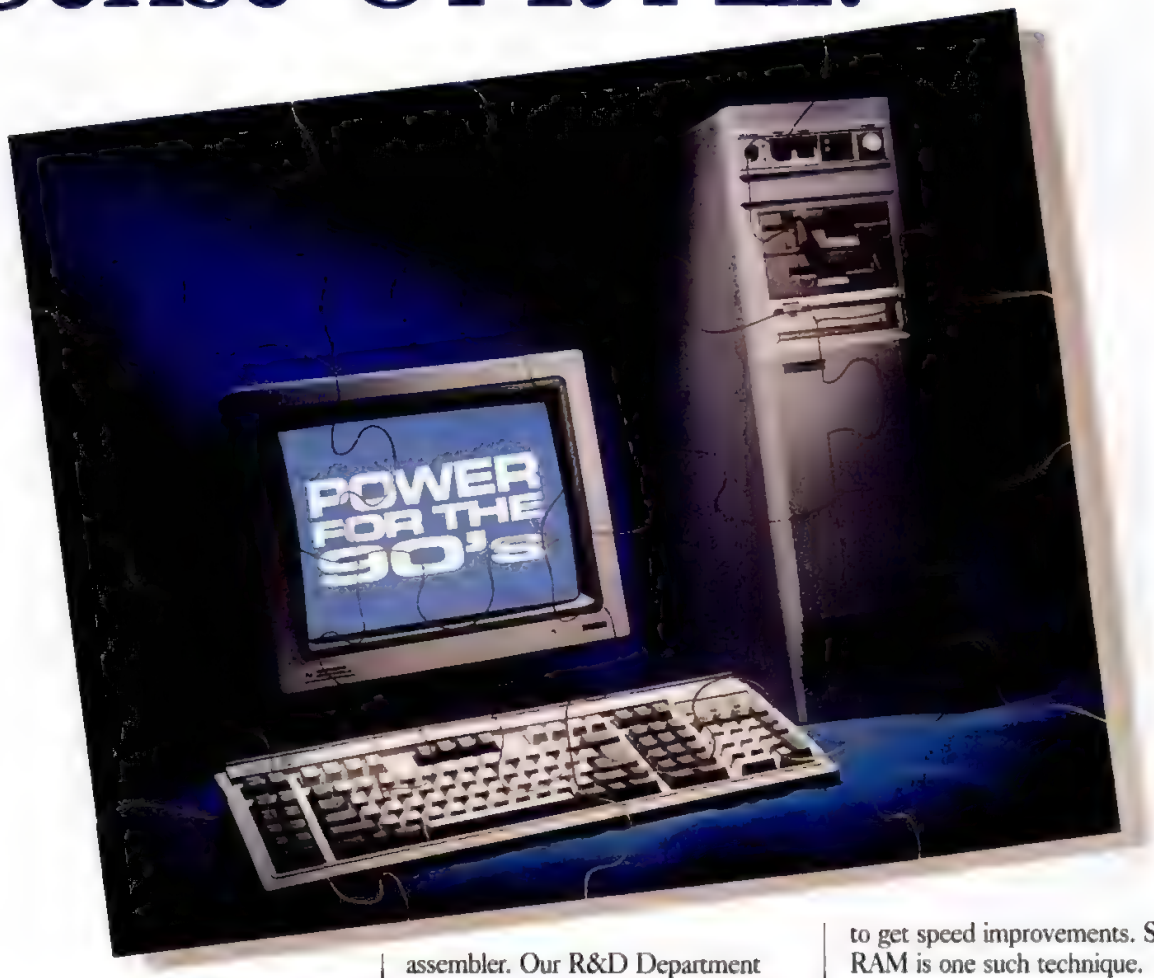

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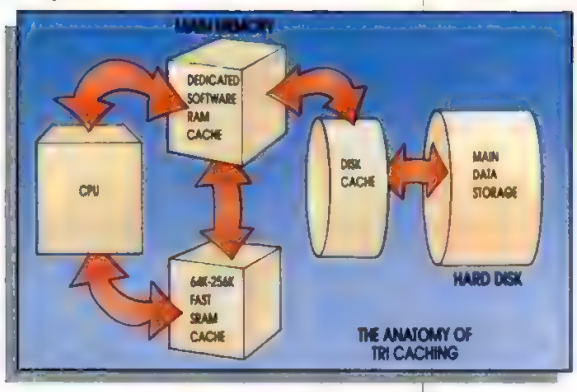

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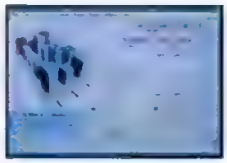

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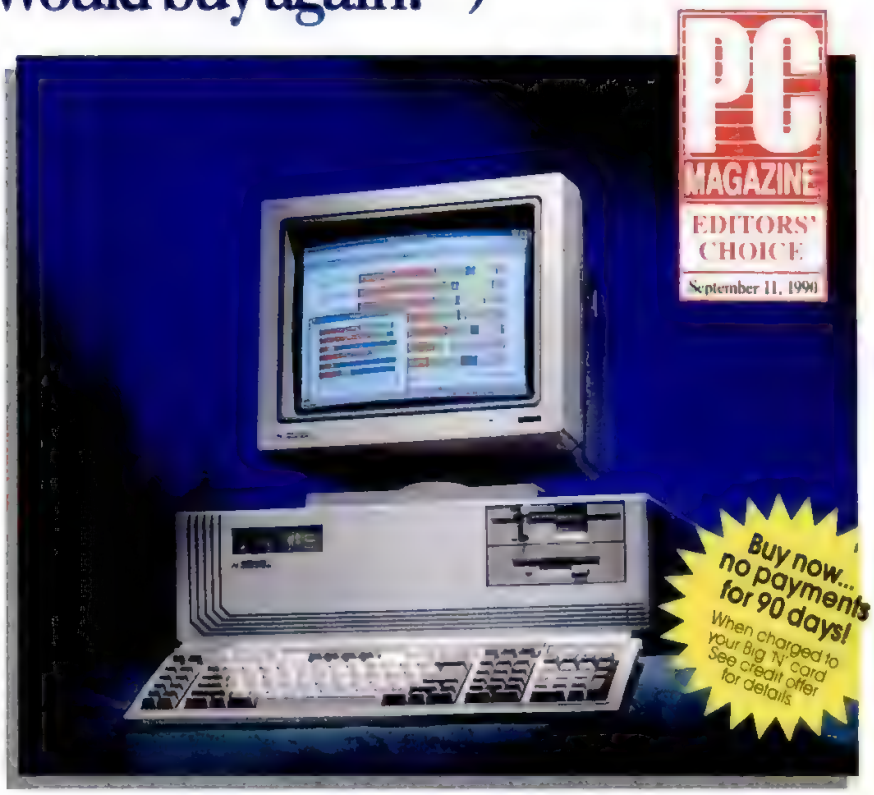

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A record five Editors' Choice Awards in one year's time!

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***InfoWorld's* editors concluded** that Northgate's 486i "leads the pack by a comfortable margin. It offers impressive performance, exceptional expandability and it is tops in support and value."†

InfoWorld showed Elegance 486i leading the pack again as a network file server and stand-alone system as well.

And, as if we had planned it, *PC Magazine* came along with its Service and Reliability issue in which Northgate's dedication to customer support was well evidenced. "As we learned more about its service policies, it became clear that Northgate stops at nothing to please its customers." No wonder "Northgate was the hands-down winner when it came to customer loyalty."**

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Northgate caching enhancements give you greater speed! We've added a 64K read write-back SRAM cache (Northgate exclusive 256K system available) to further accelerate the execution of instructions. I/O transactions are faster than ever thanks to a 32K hard drive cache controller. Finally, we armed Elegance 486/25 with Smartdrive DOS disk caching software. Result? Processing speed you must see to believe!

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Northgate doubles no-risk trial offer! We're so sure you'll love Elegance 486i, we'll let you use it RISK FREE for 60 days! If it fails to meet your expectations, return it for a full refund. No questions asked!

Elegance 486i SVGA Color System Features

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- 64K SRAM memory cache; read/write-back caching
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- Eight expansion slots; one 32-bit slot; six 16-bit and one 8-bit slot
- Weitek math coprocessor support
- One parallel and two serial ports
- 14" SVGA color monitor with 1024 x 768 resolution
- 16-bit SVGA adapter with 512 K video memory
- Clock/calendar chip rated at 5 years
- 200 watt power supply (220 watt power supply in tower case)
- Desktop case with room for 3 exposed and 2 internal half-height devices
- Front mounted reset and high/low speed controls
- Exclusive Northgate *OmniKey* keyboard
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**PC Magazine*, September 11, 1990 ***PC Magazine*, September 25, 1990
†*InfoWorld*, July 30, 1990 ††*Computer Currents*, August, 1990

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PC MAGAZINE EDITORS' CHOICE October 31, 1989

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Elegance 386's high performance motherboard is designed and manufactured by Northgate. With a 16Mb 32-bit DRAM capacity, it's consistently rated in the top 1% of performance — at 25 and 33MHz, Elegance 386 is the fastest in its class!

Tri-caching started here! Elegance was Northgate's first triple caching machine. It comes with 64K read write-back SRAM cache to accelerate the execution of instructions. (Northgate exclusive 256K system available.) A 32K hard drive cache controller accelerates I/O transactions while Smartdrive DOS disk caching software increases overall system throughput.

Zip through demanding programs. Multi-stage caching easily handles even a heavy overhead of video programs, I/O intensive tasks, network servers, large data bases and advanced desktop publishing programs.

Desktop or tower. . .your choice! Elegance 386 comes standard in our elegant five bay desktop case. Our popular seven bay tower case is also available. Either way, you get plenty of room for all kinds of I/O boards, and internal/external peripherals.

Start with our monochrome system! Northgate uses a modular approach that lets you add the components you need. Northgate's Elegance 386 mono system includes 4Mb of RAM, a 40Mb fast access hard drive, 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives, a 14" high resolution monochrome monitor and our exclusive *OmniKey*® keyboard.

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- U.S.-made motherboard
- 40Mb fast access hard drive; 16-bit controller with 1:1 interleave; 32K disk read-look-ahead cache buffer
- 64K SRAM memory cache; read/write-back caching
- High density 1.2Mb 5.25" and 1.44Mb 3.5" floppy drives; also read/write low density disks
- Eight expansion slots; one 32-bit slot; six 16-bit and one 8-bit slot
- Weitek math coprocessor support
- One parallel and two serial ports
- Hercules compatible video adapter
- Clock/calendar chip rated at 5 years
- 200 watt power supply (220 watt power supply in tower case
- Desktop case with room for three exposed and 2 internal half-height devices; optional seven bay tower case has room for three exposed and four internal half-height devices
- Front mounted reset and high/low speed controls
- Exclusive Northgate *OmniKey* keyboard
- 14" high resolution monochrome monitor
- Microsoft® Windows™ 3.0 and mouse
- MS-DOS 4.01 and GW-BASIC software installed
- On-line User's Guide to the system and MS-DOS 4.01
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*PC Magazine, October 31, 1989

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First time ever! Now you can have Northgate Elegance™ power, speed and performance in our popular space-saving SlimLine case! Elegance 386 computers shocked the industry with a #1 and #2 sweep of *InfoWorld's* 1989 best product awards; AND three Editors' Choice awards from *PC Magazine*.

Cache! Cache! Cache! Like our powerful Elegance systems, Slimline 386 features 64K SRAM cache to zip through the execution of instructions. For even more speed, we've added a hard drive cache that makes short work of I/O transactions. To top it off, SlimLine 386 comes with Smartdrive DOS disk caching software that anticipates the information you'll need and brings it into the cache for fast access.

Better features across the board! SlimLine's motherboard is fully integrated, allowing maximum system features in the smallest possible space. There's room for up to 16Mb of 32-bit RAM, one parallel and two serial ports, a built-in floppy disk controller and IDE hard drive controller. Plus an integrated SVGA video with 512K video RAM to speed bus throughput—makes the system faster and more reliable! And there's plenty more room for add-on peripherals—with SlimLine you get five open expansion slots.

Cache System!

SlimLine 386 comes with Intel®'s 386DX 33MHz processor. For faster math-based applications — budgets, forecasts, spreadsheets and databases — it features 80387 coprocessor support for adding floating point unit (FPU) speed enhancements.

All purpose system! SlimLine Cache is the perfect network workstation or stand-alone system for business and home use. It also provides excellent support for advanced desktop publishing and graphics applications.

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- 200 Mb hard drive — 15ms access
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LCOLOPT_REALIZED. For this function, the GPI presentation driver must find the color index that maps to an RGB color value that comes closest to the RGB color passed as the last parameter to the function.

Using GpiQueryRGBColor, we can investigate which RGB colors correspond to each of the color indexes. The table shown in Figure 2 shows the results of this research for the VGA (which is unchanged between OS/2 1.2 and the second beta release of OS/2 2.0) and the 8514/A, (different for OS/2 1.2 and OS/2 2.0). I've rearranged the order of the color indexes for reasons I'll discuss shortly.

In theory, the CLR_DARKGRAY and CLR_PALEGRAY indexes should map to RGB values with equal levels of red, green, and blue. You'll note for OS/2 1.2, this is not the case with the 8514/A. We'll soon see why.

OTHER COLOR QUERY FUNCTIONS

A Presentation Manager program can obtain the number of colors simultaneously available on the output device by calling DevQueryCaps like this:

```
DevQueryCaps (hdc, CAPS_COLORS,
  1L, &lNumColors) ;
```

Note that the first parameter is a handle to the device context rather than a handle to the presentation space. A program can get the device context handle from the presentation space handle by calling GpiQueryDevice. On return from the DevQueryCaps function, the lNumColors value will be 16 for the EGA or a standard VGA, and 256 for some Super VGA boards and the IBM 8514/A.

You can then allocate a block of memory large enough for an array that will contain lNumColors LONG values. If the pointer to this block of memory is named alColors, you can call this function:

```
GpiQueryRealColors (hps, 0L, 0L,
  lNumColors, alColors) ;
```

On return, the alColors array will contain the RGB color values representing the colors currently loaded in the video board's palette table. This array of RGB color values is the physical color table. It consists of all the colors that can currently be rendered on the output device.

The general syntax of GpiQueryRealColors is

```
GpiQueryRealColors (hps,
  flOptions, lStart, lNum,
  alColors) ;
```

The program can obtain only a part of the physical color table by using the lStart and lNum parameters. If the flOptions is set to LCOLOPT_INDEX, then lNum must be doubled and the alColors array must be twice as large. GpiQueryRealColors will fill the alColors array with alternate color indexes and corresponding RGB color values. If a particular RGB color value has no corresponding color index, the index value will be set to CLR_NOINDEX, equal to -254. (The flOptions parameter can also include the LCOLOPT_REALIZED flag.)

The next function returns an RGB color value in the physical color table that most closely matches the RGB color value passed as the last parameter:

```
lRgbColor = GpiQueryNearestColor
  (hps, flOption, lRgbColor) ;
```

Again, the flOption can be either 0L or LCOLOPT_REALIZED.

THE PHYSICAL COLOR TABLE

The presentation driver for the video display is responsible for configuring the video board hardware, including loading the palette table. The total array of 24-bit RGB color values that correspond to the entries in the palette table is the physical color table. This is the table obtained from GpiQueryRealColors. Each 24-bit RGB value in the physical color table corresponds to a particular pixel-bit value that the presentation driver writes into video memory when drawing.

At first, it doesn't seem as if the mapping from pixel-bit values to RGB color values would be important to a PM application. This should be the sole responsibility of the video display presentation driver. Moreover, even if this is of some concern to a PM application, it doesn't seem possible to obtain the information. But let's give it some thought.

If you create a bitmap that matches the color capability of the video display, you can use GpiBitBlt to copy part of the video display into that bitmap. Each pixel in the bitmap is represented by a 4-bit value for the EGA and VGA, or an 8-bit value for some Super VGAs and the 8514/A.

It's quite likely that these values in the bitmap are true pixel-bit values, allowing the presentation driver to copy the bitmap to the video display as quickly as possible.

If you then use GpiQueryBitmapBits on this bitmap, you can obtain the bitmap color table as an array of RGB or RGB2 structures. You'll find that the colors in these RGB structures are in the same order as the array of colors returned from the GpiQueryRealColors function.

This seems to indicate that the RGB

RGB COLOR VALUES FOR VGA AND 8414/A

	VGA			8514/A (OS/2 1.2)			8514/A (OS/2 2.0)		
	R	G	B	R	G	B	R	G	B
CLR_BLACK	00	00	00	00	00	00	00	00	00
CLR_DARKBLUE	00	00	80	00	00	55	00	00	AA
CLR_DARKGREEN	00	80	00	00	49	00	00	92	00
CLR_DARKCYAN	00	80	80	00	49	55	00	92	AA
CLR_DARKRED	80	00	00	49	00	00	AA	00	00
CLR_DARKPINK	80	00	80	49	00	55	AA	00	AA
CLR_BROWN	80	80	00	49	49	00	AA	92	00
CLR_DARKGRAY	80	80	80	24	24	55	5A	5A	5A
CLR_PALEGRAY	CC	CC	CC	49	49	55	9C	9C	9C
CLR_BLUE	00	00	FF	00	00	FF	00	00	FF
CLR_GREEN	00	FF	00	00	FF	00	00	FF	00
CLR_CYAN	00	FF	FF	00	FF	FF	00	FF	FF
CLR_RED	FF	00	00	FF	00	00	FF	00	00
CLR_PINK	FF	00	FF	FF	00	FF	FF	00	FF
CLR_YELLOW	FF	FF	00	FF	FF	00	FF	FF	00
CLR_WHITE	FF	FF	FF	FF	FF	FF	FF	FF	FF

Figure 2: The RGB color values that correspond to the color indexes shown in Figure 1.

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colors returned by GpiQueryRealColors correspond to the entries in the video board palette look-up table in the order of incremental pixel-bit values beginning with 0. The Microsoft documentation doesn't come right out and say so, but it's certainly implied by the statement: "If [the lStart] parameter is zero, this function copies from the start of the physical palette."

If you call GpiQueryRealColors for the VGA, you'll get 16 RGB color values in the order shown in Figure 2. (That's why I rearranged the order of the color indexes for this figure.) My conclusion is that the VGA palette is configured so that the pixel bits are good old IRGB values:

```
+-+-+-+-+
|I|R|G|B|
+-+-+-+-+
```

Once again we see that IRGB—originally devised for character modes of the CGA—is still very much with us, even under the Presentation Manager.

When running with the 8514/A under OS/2 1.2, the GpiQueryRealColors function returns 256 RGB color values. The table begins

R	G	B
00	00	00
00	00	55
00	00	AA
00	00	FF
00	24	00

and concludes

R	G	B
FF	DB	FF
FF	FF	00
FF	FF	55
FF	FF	AA
FF	FF	FF

There are eight different Red values: 00, 24, 49, 6D, 92, B6, DB, and FF. For each Red value, there are also eight different Green values: 00, 24, and so forth. For each Red and Green combination, there are four different Blue values: 00, 55, AA, and FF. This is why the 8514/A under OS/2 1.2 is not capable of true gray shades. The only possible combinations of equal Red, Green, and Blue values are 00-00-00 (black) and FF-FF-FF (white).

The way these RGB values are ordered implies that the actual pixel-bit values in the 8514/A can be interpreted as an 8-bit RGB color encoding, like this:

```
+---+---+--+
|RRR|GGG|BB|
+---+---+--+
```

For example, if the pixel-bit value is 01011001, the RGB color value is 49-DB-55.

Under OS/2 2.0, the physical color table for the 8514/A has been changed. It now includes 32 true gray shades. This table begins with 16 grays shades, with equal Red, Green, and Blue values of 00, 08, 10, 19, 21, 29, 31, 3A, 42, 4A, 52, 5A, 63, 6B, 73, and 7B.

The physical color table continues with Red values of 00, 2B, 55, 80, AA, D5, and

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FF. Note that there are only seven Red values rather than eight. For each Red value, there are eight Green values of 00, 24, 49, 6D, 92, B6, DB, and FF. For each Red and Green combination, Blue values are 00, 55, AA, and FF.

The table then concludes by listing the remaining 16 gray shades: 84, 8C, 94, 9C, A5, AD, B5, BD, C5, CE, D6, DE, E6, EF, F7, and FF.

There are two things to note: First, there are two values in the color table for white and two for black. Moreover, it isn't possible to indicate in a consistent manner how the pixel bits correspond to particular RGB colors.

WHY DO WE CARE?

The question remains: Do we really care how pixel-bit values map to visible RGB colors? You bet we do. Why does it matter? Raster operations, that's why.

> GPI performs raster operations on the pixel-bit level. If pixel-bit values don't parallel RGB values, then these operations may yield some unusual results.

Raster operations are supported in two different ways in GPI. First of all, the GpiSetMix and GpiSetBackMix allow setting foreground and background *mix modes*. These mix modes determine which bitwise operation is performed between the pixels of the graphic primitive you're drawing and the pixels of the existing display surface. For example, you can use GpiSetMix to set a foreground mix to FM_XOR. This means that GPI will perform a bitwise exclusive-OR operation between the pixels of your graphic primitive and the pixels of the display surface. Secondly, the Gpi-BitBlt function allows you to set a raster operation among three objects—a source bitmap, a pattern, and a destination surface.

Here's the important point: GPI performs these raster operations on the pixel-bit level. If the pixel-bit values do not correspond to RGB color values consistently (as is the case for the 8514/A under the second beta release of OS/2 2.0), then these raster operations may produce unusual results for some color combinations. Let's look at an example.

We'll assume the background of a window was colored with CLR_BLUE. The RGB color value for CLR_BLUE is 00-00-FF. Now suppose you set the mix mode to FM_XOR and the color to CLR_RED (which has an RGB color value of FF-00-00) and draw. In theory the result should be the same as CLR_PINK with an RGB color value of FF-00-FF.

Under OS/2 1.2 running with an 8514/A, this is definitely the case. The pixel bits corresponding to these two colors and the XOR result are shown below:

```
Blue:          00000011
Red:           11100000
XOR Result:    11100011
```

The resulting pixel-bit value corresponds to the RGB value of FF-00-FF, which is CLR_PINK.

Under OS/2 2.0, this doesn't work. The RGB value of 00-00-FF (CLR_BLUE) has a pixel-bit value of 00010011. The RGB value of FF-00-00 (CLR_RED) has a pixel-bit value of 11010000.

```
Blue:          00010011
Red:           11010000
XOR Result:    11000011
```

The XOR result has a corresponding RGB value of D5-92-FF—considerably lighter than CLR_PINK.

Thus, the result of some raster operations using some colors can't be predicted without closely analyzing the physical color table. Fortunately, the physical color table for the 8514/A under OS/2 2.0 is constructed with a certain amount of symmetry to minimize these problems. For example, the FM_INVERT mix mode always works. Moreover, if you want to accurately predict the results of raster operations, you can obtain the necessary information from GpiQueryRealColors.

Now that we've explored the physical color table, we're ready to take a close look at the logical color table. We'll do that in the next issue. ■

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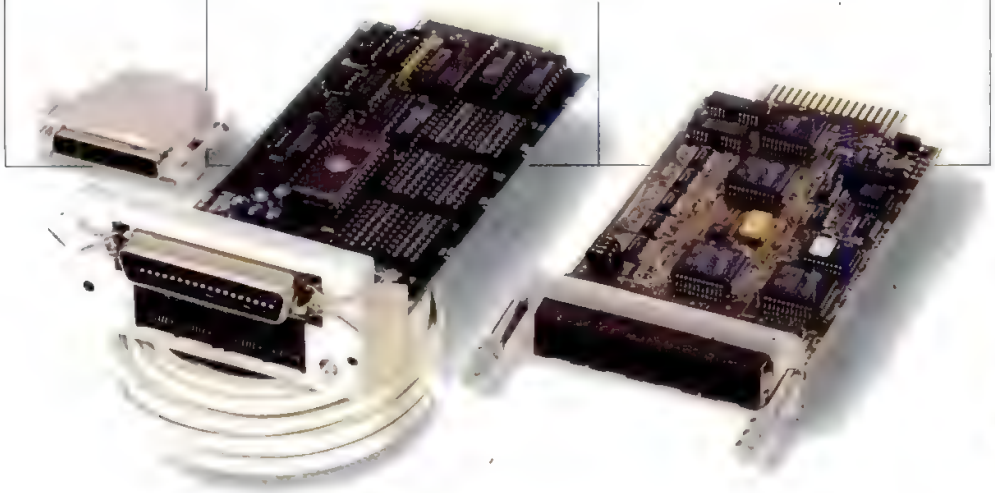

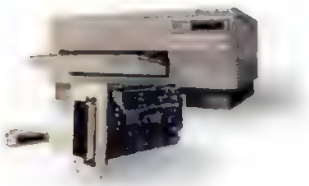

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by
Ray Duncan

Power Programming

Constructing a Compact Disk Library With ToolBook

Asymetrix's *ToolBook,* which has been described by its authors as a "software construction set," brings an entirely new class of capabilities to IBM PC compatibles running *Windows* 3.0. Although *ToolBook* supports a powerful object-oriented programming language (OOPL) called OpenScript, very useful applications can be built visually, with little or no coding in the traditional sense. In this column, I'll show you the step-by-step construction of a simple *ToolBook* database and user interface, which will give you some flavor of this development environment's power and also of its limitations.

My goal for this installment was to provide you with a *ToolBook* application you'd find both attractive and practical. I racked my brain for at least a couple of minutes before I came up with the obvious solution: a Compact Disk Library. After all, a door-to-door poll of the households on my block demonstrated conclusively that a correlation exists between personal-computer and compact-disk-player ownership!

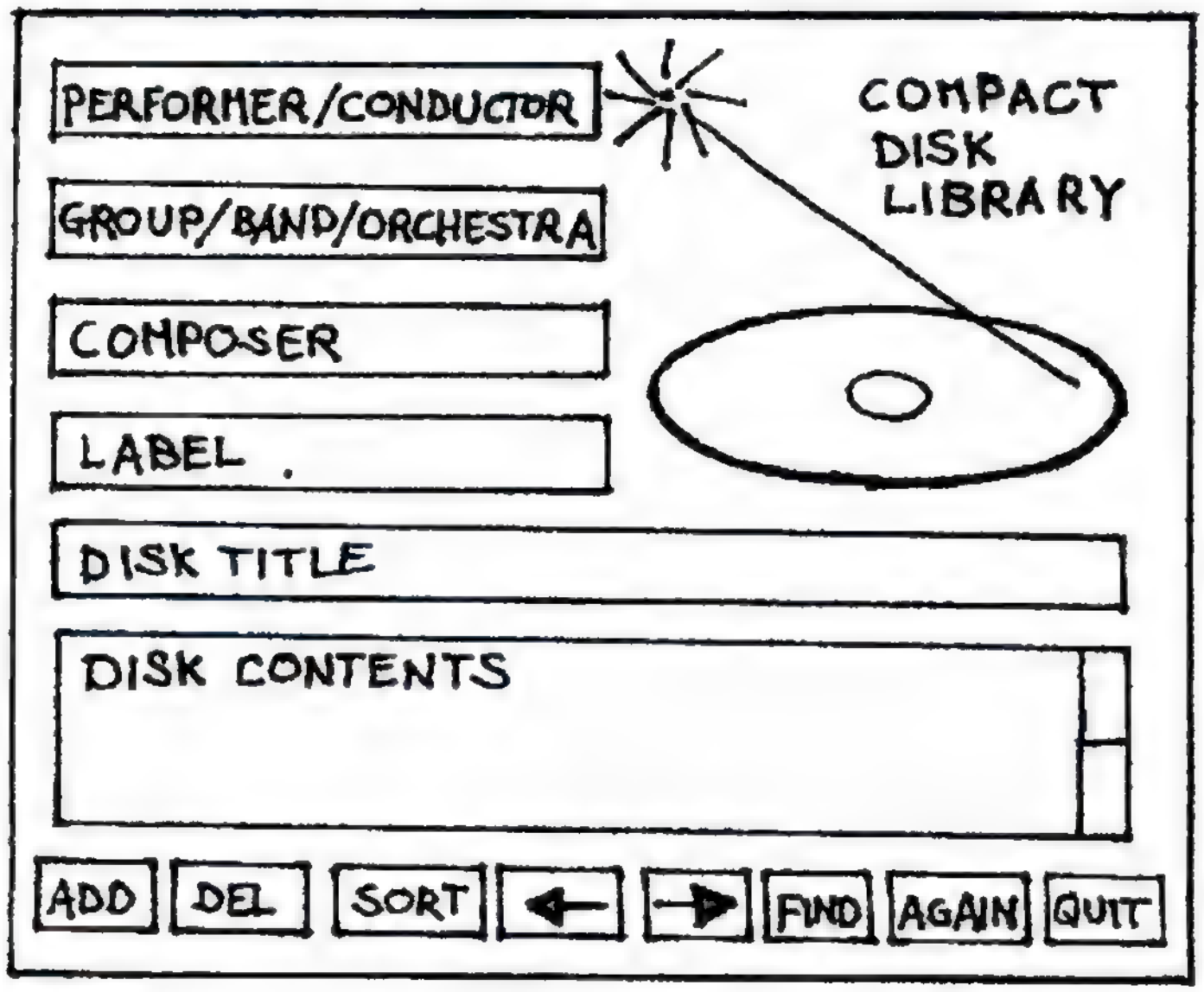
The file CD.TBK is posted for downloading in the Power Programming Library of the PC MagNet Programming Forum. If you own the "generic" retail version of *Microsoft Windows* Version 3.0, which includes the *ToolBook* runtime libraries, you have everything you need to *use* CD.TBK on your system. However, if you want to *change* the CD.TBK application, you need the full Asymetrix *ToolBook* authoring package, which has a list price of $395 and is available from many dealers of programming tools including Programmer's Paradise and Programmer's Connection.

Programmers who intend to develop commercial applications in *ToolBook* may also want to purchase the Asymetrix *Author's Resource Kit* (ARK), which is available directly from Asymetrix for $495. The ARK contains two important source code management tools: BOOKLOOK, a sort of browser/inspector utility which allows you to inspect, change, and print object properties and scripts; and REMOVER, which protects your work by stripping an application of readable scripts, leaving behind only the compiled code. The ARK also includes a couple of rather half-baked "example" books on colors and graphic design, and an unlimited license to distribute the *ToolBook* runtimes with your application.

> ■ Building a *ToolBook* application is very much a visual process, so a visual demonstration is both appropriate and instructive.

Figure 1
Design phase

After a little thought, I arrived at the following list of information I wanted to store in a *ToolBook* database: performer or conductor, group or band or orchestra, composer, publisher's label and disk identification number, disk title, and a list of the disk contents. I also wanted to be able to add,

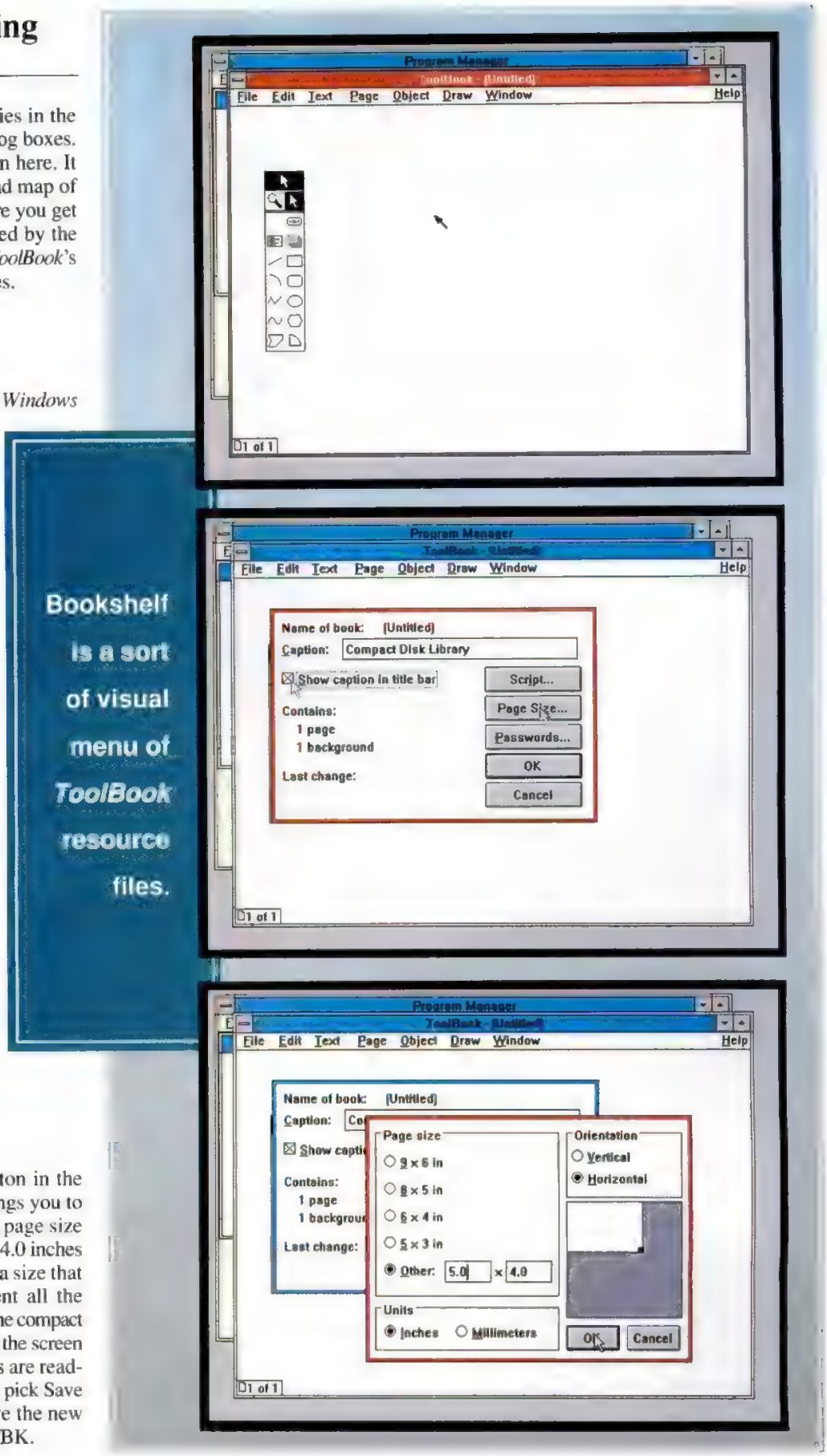


delete, sort, and search for entries in the database, using buttons and dialog boxes. My preliminary sketch is shown here. It really helps to have a rough road map of your proposed application before you get started, so you don't get diverted by the temptation to fiddle around with *ToolBook*'s drawing tools and other goodies.

Figure 2
Implementation phase
First, launch *ToolBook* from the *Windows* task manager, and *ToolBook* displays its master book called Bookshelf (not shown). Bookshelf is a visual menu of *ToolBook* demonstrations and resource files, such as DayBook. Pick New Book from this menu and you're presented with a pristine book containing one blank page on a blank background. The legend on the main window shows you that the book is as yet Untitled.

Figure 3
Assigning a name
To get things rolling, select Book Properties from the Object menu. This displays the dialog box shown here. Now you can assign the book a more descriptive name—such as Compact Disk Library—and force this name to be displayed in the title bar (instead of the filename) by clicking on the Show caption . . . check box.

Figure 4
Setting page size
Clicking on the Page Size button in the Book Properties dialog box brings you to yet another dialog box. Set the page size of the new application to 5.0 by 4.0 inches with a horizontal orientation—a size that will be large enough to present all the useful information about each of the compact disks, yet leave enough room on the screen so that other active applications are readily visible and available. Finally, pick Save As from the File menu and give the new application the filename CD.TBK.



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The Playroom ..... 24.
Where in Time is Carmen
San Diego? ..... 28.

Brown-Wagh Publishing
Sound Blaster 1.5 ..... 164.

Electronic Arts
Secret of Monkey Island ..... 40.
The Games People Play ..... 26.
Stormovik: SU-25 Att. Ftr ..... 33.
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Figure 5
Background properties

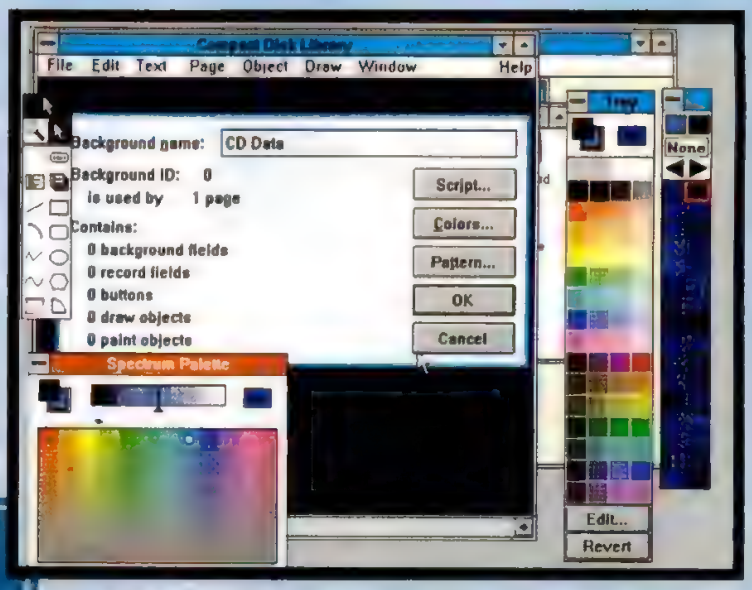
Now that we've established the overall book properties and page size, we need to work on the background, which will be shared by all the pages in the book. Selecting Background from the Page menu (or pressing the F4 key) switches you to background mode. (The Background/Foreground cue in the lower-left corner of the window is obscured in this screenshot, but it's visible in some of the other figures). Choosing Background Properties from the Object menu allows us to name the background CD Data, and clicking on the Color and Pattern buttons brings up the various color palettes. I've chosen a dark blue background with a herringbone pattern for this application.

Figure 6
Background record field

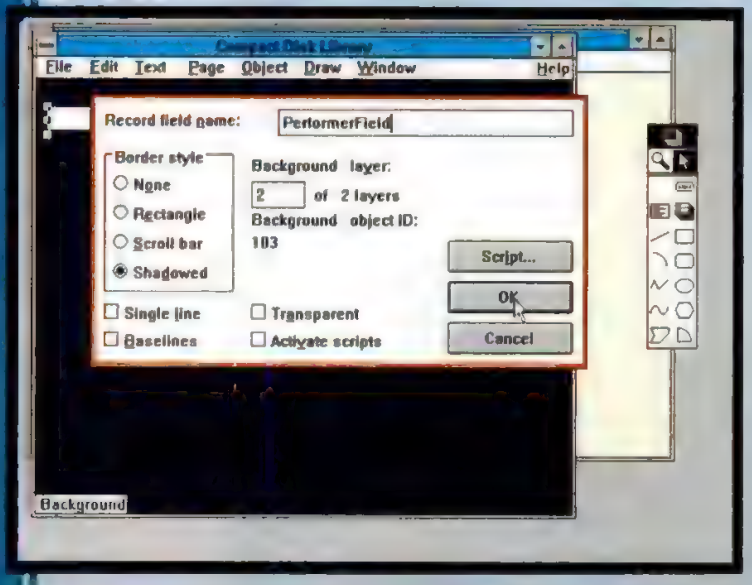
Here you draw the first background record field (for the performer or conductor), then assign a name, background layer number, and the shadowed attribute using the RecordField Properties dialog box from the Object menu. Record fields are the heart of a *ToolBook* database; they appear in the same position on every page but contain different text on every page. Record fields can also be the target of search, search-and-replace, or sort operations.

Figure 7
Background title

Now create the first background title, which is really an ordinary text field. Place it above the first record field using the mouse, then fill it in using the keyboard. Using the Field Properties dialog box from the Object menu, you can make the field transparent without any border so that the background color will show through. The text is assigned a stroke color of white using the color tray (not shown here).



Record fields are the heart of a *ToolBook* database.



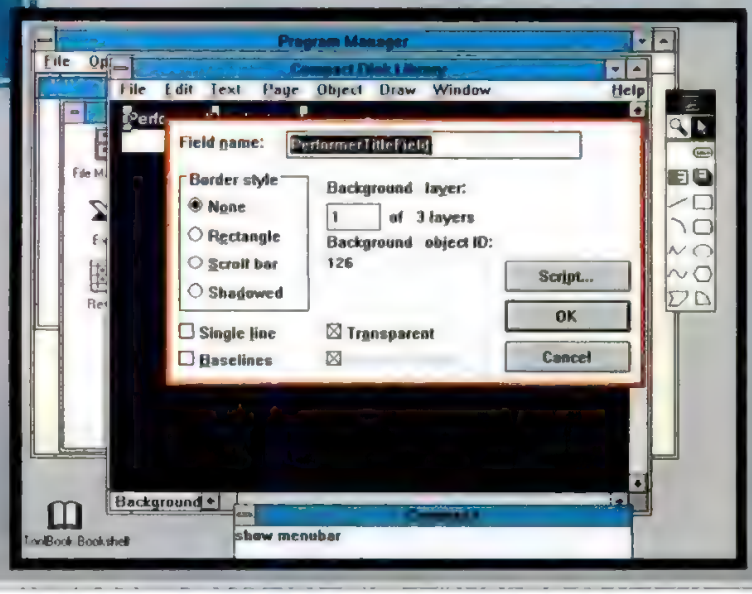


Figure 8
In position

The first record field and title in a background text field are shown in their final positions. You use the Character dialog box from the Text menu (not shown) to define the default text style. I chose System font, 9 point, plain for the record field and used the Paragraph dialog from the Text menu (not shown) to give text typed into the record field an indent of .1 inch. Using the Character dialog box, I defined the title text as 9 point, boldface Helvetica. It's easy to clone the remaining title and record fields, using *ToolBook*'s object copy-and-paste capability.

Figure 9
The other fields

The initial record and title fields have been copied, pasted, and modified to implement the remainder of the database. The last two record fields have been stretched laterally to allow them to display more text per line, and the last field has been given a scroll bar so that it can hold as many lines as necessary. Since text fields can't be assigned the shadow and scrollbar styles at the same time, I've emulated the drop-shadow style on the Contents field by drawing a thick black line along its lower border.

It's easy to clone text and record fields using the copy-and-paste capability.

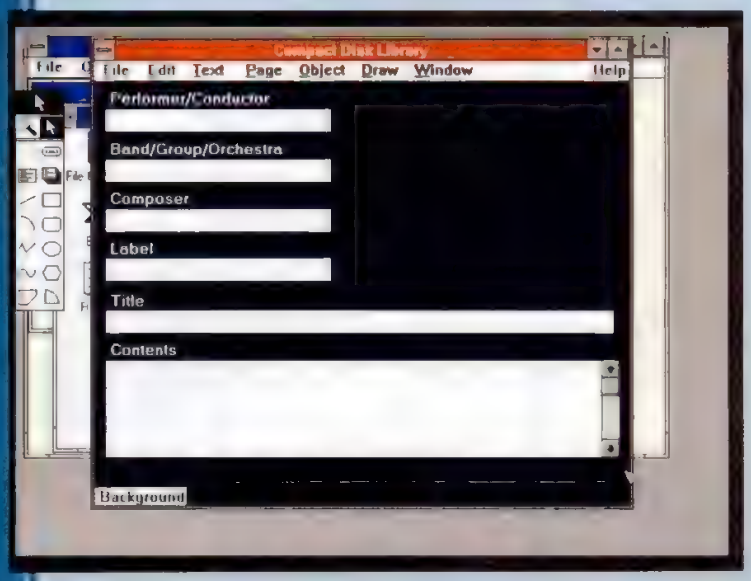


Figure 10
Creating a button

It's time to add the buttons to the page background. Unfortunately, the default button styles supported by *ToolBook* are plain compared with the three-dimensional buttons offered by *Windows* 3.0. So, let's open a temporary book named SCRATCH .TBK and create a fancier-looking button by superimposing a transparent true button with a rectangular border and three simple graphic objects. The button element is given the highlight property, meaning it will invert or reverse its colors when clicked with the mouse. All four objects are grouped into a single object using the Group command on the Object menu.

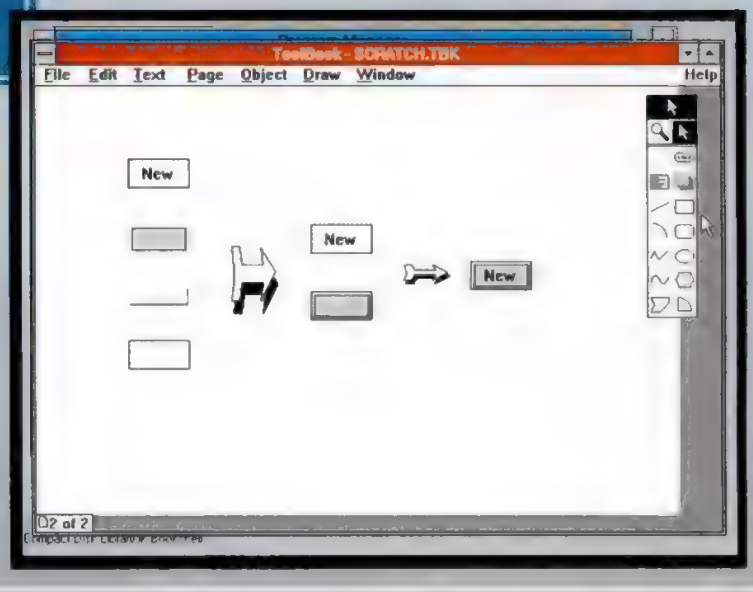


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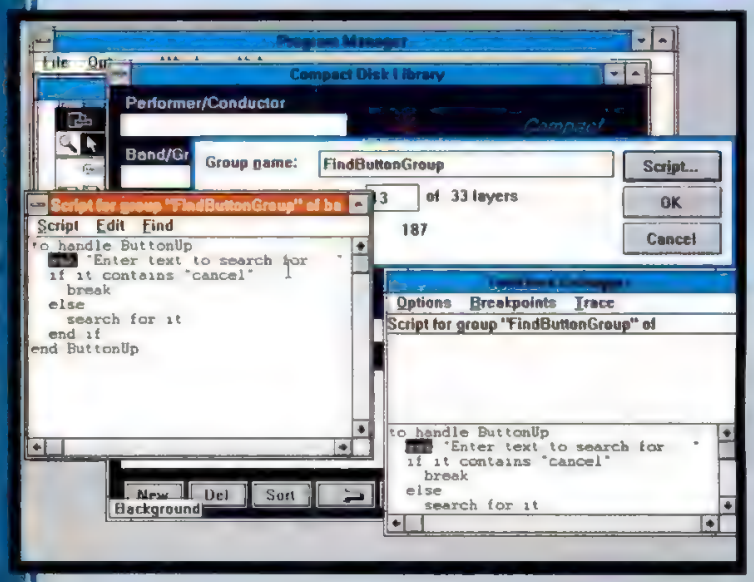
Figure 11
Adding more buttons
The button we built has been copied and pasted into the CD Library and cloned to form eight buttons. The left and right arrows on the two middle buttons were pasted in from *ToolBook* 's clip-art book. The entire set was then aligned vertically using the Align command on the Draw menu. These buttons don't do anything yet.

Figure 12
Attaching scripts
OpenScript programs are attached to each button using the Script Editor, and tested using the Debugger. The programs are activated when the corresponding button is clicked with the mouse. The script for the Find button is shown in the editing window next to the debugging window. This script executes the Ask command to pop up a dialog box and get the search target text from the user, and it then carries out the search. If a match is found, the page containing the matching text is displayed, with the text selected and highlighted.

Figure 13
Finishing up
Some decorations are added using *ToolBook*'s filled ellipse and line-drawing tools and another transparent text field. A script, attached to the book hides the menu bar when the book is entered, and forces the window size to equal the page size (so no scroll bars are necessary). This restricts the user to the interface provided by the buttons along the bottom of the window and prevents him from inadvertently damaging the book's structure. The menu bar is restored when the book is exited.

OpenScript programs are attached to each button using the Script Editor.



THE IN-BOX

Please send your questions to me at any of the following e-mail addresses: PC MagNet: 72241,52; MCI Mail: rduncan; BIX: rduncan ■

by
William S. Hall

Windows

AM I IN WINDOWS OR DOS?

When I shell out to DOS from *Microsoft Windows*, I sometimes forget where I am. I often type WIN instead of EXIT (or ALT-TAB), thinking that I have to run *Windows* rather than return to it. This mistake is not as harmless as it seems: Executing *Windows* inside *Windows* may cause problems. At the very least, the screen colors change and the mouse stops working—both signals of an unstable system and a possible crash. As a solution, you can modify the DOS prompt so that it contains a message reminding you to type EXIT.

To change the prompt automatically when you shell out to DOS, create a .PIF file that runs COMMAND.COM with the /C parameter. The /C parameter enables COMMAND.COM to execute a batch file, which in this case will change the prompt and execute another copy of COMMAND.COM. The second copy will inherit the new prompt; the old prompt will be restored when you type EXIT.

The procedure requires three steps. First, create a batch file, DOS.BAT, which should contain the following lines:

```
@echo off
prompt Type EXIT to return to
Windows$_%PROMPT%
%COMSPEC%
```

The @echo off suppresses the display of the batch commands as they are executed. The second line of the batch file contains the contents of the prompt; you can, of course, change the statement to suit yourself. The $_ generates a carriage return after the prompt, and the %PROMPT% variable places your normal prompt on a second line. Of course, %COMSPEC% is the full pathname of COMMAND.COM. When the batch file reads this line, COMMAND.COM will execute with the new prompt.

Put the file wherever you normally keep your batch files; for the purposes of this example, we will assume that the directory is called \BAT.

- **AM I IN WINDOWS OR DOS?: Use a simple batch file to change the DOS prompt temporarily to remind you that you're still in *Windows*.**
- **ALL THIS MEMORY AND NO MORE ROOM: You might have truckloads of RAM, but the number of windows and apps you can run depends on the 64K limit.**
- **SAVING THE CONFIGURATION: With the help of a DOS window, you can save configurations without having to exit *Windows*.**

To have *Windows* execute the batch file, you'll have to make a Program Information File (PIF); you can then associate the PIF with an icon. Using the *Windows* PIF editor, create the file CMMD.PIF that contains the fields:

```
Program Filename:        COMMAND.COM
Window Title:            DOS
Optional Parameters:
 /E:225 /C C:\BAT\DOS.BAT
```

Click OK to accept the defaults for the rest of the parameters. The /E:225 parameter increases the size of the environment space from the normal default size of 160 to handle the long prompt line. You don't have to use the value 225. The idea is simply to choose a number larger than your current environment space.

From the Program Manager, create an application icon in a convenient group with the description DOS Prompt and the command line CMMD.PIF.

Double-clicking on the new DOS prompt icon launches CMMD.PIF. CMMD.PIF runs an instance of COMMAND.COM (with environment space as determined by the /E parameter) whose /C parameter says to execute DOS.BAT and then return to *Windows*. But DOS.BAT itself runs another instance of COMMAND.COM (via the %COMSPEC% variable), which stays active with the new prompt until it is exited.

The procedure is kludgy, but it is the only effective method I've found for changing the prompt without writing extra programs. To help conserve memory, I have also limited the environment space to just enough to handle the longer prompt string. However, if you have already expanded your environment space with the /E parameter in CONFIG.SYS, you may have to use a larger value than the 225 bytes suggested above.

Kathy Kowell
Cincinnati, Ohio

At the company where I work, I develop *Windows* applications from within *Windows* itself. Often to edit source code, I launch a DOS shell, edit the source, compile, and then accidentally run *Windows* again to test the result. The error comes from a combination of forgetfulness and old habits: Until the advent of *Windows* 3.0, you always had to exit *Windows* to run the compiler; the standard application support in *Windows* 2.*x* was just inadequate for the task. If the source was even moderately large, there was never enough memory to run the compiler.

This procedure works as promised, except that I needed to increase the environment space from the suggested 225 bytes to 512—the amount I normally use anyway. Also note that you will lose some memory—about 6K—in the shell.

I also decided to try another form of the prompt—one with the reminder message posted in inverse video along the top-right of the screen and my regular DOS prompt

in the normal place. To do this, you have to load ANSI.SYS at boot time. Simply enter the line

```
device=[path]ANSI.SYS
```

into CONFIG.SYS and change the prompt line in DOS.BAT to

```
prompt $e[s$e[0;45H$e[7mALT-TAB or
  EXIT to return to
  Windows$e[m$e[u$p$g
```

Here is what these mysterious ANSI escape sequences mean:

```
$e[s        saves cursor position
$e[0;45H    moves cursor to row 0,
             column 45
$e[7m       enters inverse video
$e[m        sets normal video
$e[u        restores saved cursor
             position
```

The final pg displays the usual prompt of the current path. Note that all this comes at additional 4K cost of memory to support ANSI.SYS.

If you don't mind losing some automation, you can save some memory by eliminating the PIF step. Simply create a batch file that will set the prompt you want. Then, execute the batch file after you shell out to DOS. But if the complex prompts suggested above exhaust the environment space, you may have to make up a PIF similar to CMMD.PIF; you could use the optional parameters /E:512. This should give you enough space to run the prompt batch file. Note that there's nothing magic about the value 512; the point is that you should pick a number that is larger than the number that you have already specified in your CONFIG.SYS file.

Here is a simpler way to change the shell's prompt. Run *Windows* from a batch file like this:

```
@ECHO OFF
REM WINDOWS.BAT
SET oldprompt=%PROMPT%
PROMPT Type EXIT to return to
 Windows$_%PROMPT%
WIN
PROMPT %oldprompt%
SET oldprompt=
```

Any time you shell out of *Windows*, the prompt will serve as a reminder. It does require that you have enough spare environment space to keep a copy of the PROMPT. Again, you set the amount of space with the /E parameter on a SHELL= line in CONFIG.SYS.

In OS/2, whenever you are in a full-screen command shell, there is an optional banner along the top line to remind you how to call up the task manager. A similar feature in the next version of *Windows* would be extremely desirable.

ALL THIS MEMORY AND NO MORE ROOM

Could you explain what the lines "Free Memory" and "Free System Resources" mean in the Program and File Manager's About box? I have a 33-MHz 386 machine with 8MB of RAM. I have also set up a 4MB permanent swap file. The thing that puzzles me is that if I load *Microsoft Excel*, *Microsoft Word*, and a few other utilities, I run out of Free System Resources, but I still have tons of memory left. The applications report that they are "out of memory" or "low on memory." What is going on here? Is there anything I can set to allow access to the rest of my memory?

John Overstreet
Sugar Land, Texas

Free Memory is exactly what you think it is: a measure of how much memory is available for *Windows* to run applications. *System Resources*, on the other hand, is a measure of how much space is left in the data segment of USER.EXE and GDI.EXE. USER and GDI are two core modules of *Windows*.

USER manages a variety of tasks. One of these tasks is to maintain information about each window in the system. Each window requires a block of data allocated to a region of USER's data segment called the *local heap*. Also vying for space in the data segment are USER's static variables and its stack. A sketch of the data segment is shown in Figure 1. A segment on an 80x86 CPU cannot exceed 64K of memory. So if enough windows have been created in the system, you might run out of resources before you reach the end of system memory.

GDI also maintains a collection of items in its local heap to support drawing: pens (for drawing lines), brushes (for filling areas), and other assorted objects. This space can also be exhausted when a number of programs are running.

The "Free System Resources" line, which indicates how much more the heap can expand, *is* the percentage of free local heap space left in GDI or USER, whichever one is smaller. This percentage does not in fact refer to the 640K limit but to the 64K limit! Once the resources are used up, no amount of extra system memory will help.

Once you use up the Resources, you have no choice but to close one or more of your *Windows* applications. So if you receive a warning that you are low on memory, be sure to check the resources available, and if the value is 10 percent or less, close the applications you do not currently need. You may also want to avoid using the `load=` line under the [windows] section of WIN.INI. Loading up a lot of *Windows* applications you don't immediately use eats into Resources unnecessarily.

You may question the wisdom of keeping information about resources in the data segment's heap. It's a design decision that improves performance, however. Data stored in the local heap is accessed faster than if it were stored in another segment (local accesses require only 16-bit addresses; intrasegment manipulation must be done with 32-bit addressing, which requires more CPU time). But even within these limits, you should

Figure 1: The number of windows you can open at any one time depends on the amount of free local heap space in USER.EXE's data segment. Once the heap is full, you have exhausted the system resources and can open no more windows regardless of how much free system memory you have left.

be able to run a reasonable number of programs concurrently. If you have a large number of programs loaded, performance drops off anyway. You will probably be more satisfied if you run only those programs that you need in order to perform the tasks at hand.

SAVING THE CONFIGURATION

To speed up exiting *Windows*, I don't check the Save Configuration box in the Exit Windows dialog box. Occasionally, however, I do want to save the Program Manager's configuration but don't want to quit and then restart *Windows*. I have found that the following procedure works rather well:

- First, open a window such as COMMAND.COM or any standard DOS application.
- Return to the Program Manager with Alt-Tab, thus leaving the DOS window open.
- Quit *Windows* (leaving the DOS window running). When prompted, save the configuration by checking the box and click on OK. *Windows* saves your configuration and then responds that it cannot close, because a DOS program is still active.
- Check OK and continue to work in *Windows*. If you want, exit the DOS program you just ran.

Lester Henderson
Dallas, Texas

Unfortunately, the Program Manager does not provide a way to save its configuration until you exit. The trick outlined above by Mr. Henderson works because during the exit sequence, the Program Manager carries out the update of its .GRP files in the *Windows* directory *before Windows* discovers that a DOS application is still active. When the running DOS application is found, the shutdown is aborted, and you can then continue working with your new configuration, knowing that it has already been recorded.

If you simply close *Windows*, check the Save Changes box, and then abort the exit, the check mark that you just entered will not be there when you really exit from *Windows*. The value of the Save Changes box is written as follows:

```
[Settings]
SaveSettings=0
```

to PROGMAN.INI, a private .INI file in your *Windows* directory. The box is updated only when you really exit *Windows* or save the configuration, using the method outlined above.

Here is another related tip. In a program group, if you change the position of an icon within the group and then do not save the configuration either by the means just mentioned or when you exit, the new position will not be recorded. But if you simply move the icon to another program group and drop it, then pick it up again and put it back where you really want it, the position will be recorded.

OPENING WINDOWS

Share your experiences with the *Windows* environment. We'll pay you $50 for any tips we print. Mail your contributions on-disk, with a printout, to Windows, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions).

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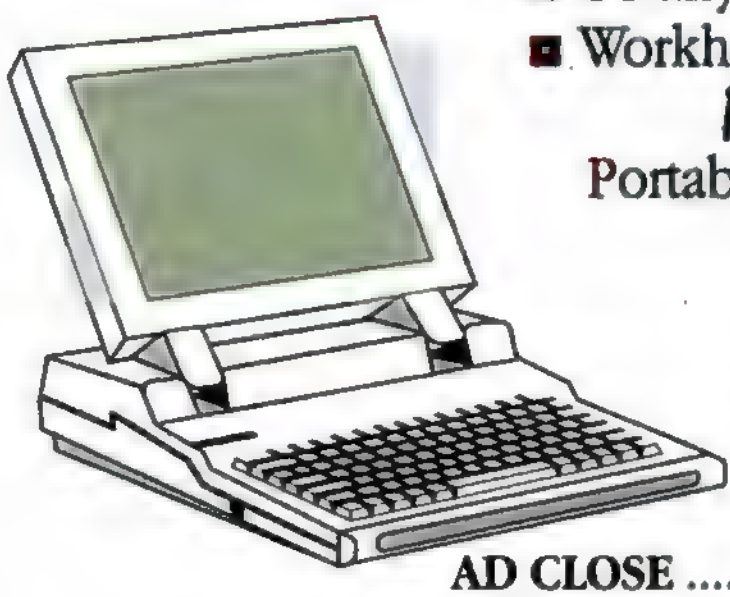

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by
Craig Stinson

Spreadsheets

UNDEFINE PRINT AREAS AND TITLES

If you print an *Excel* worksheet without defining a print area, *Excel* prints the whole worksheet. But after you define a print area, the printout will cover only the defined area. Does *Excel* have a command that would let me "undefine" a print area so that the program can once again print the entire worksheet?

I have a similar question about print titles. Is there a convenient way to remove them once they've been defined?

Howard Williams
New York, New York

Yes and yes. When you use the Set Print Area or Set Print Titles command on the Options menu, *Excel* adds the current selection to its list of defined ranges. You can see this by defining a print area and then pulling down the Formula menu and choosing Define Name. In the Define Name dialog box is an entry called Print_Area (see Figure 1). The range to which that name is assigned is the range that *Excel* will output the next time you choose File Print.

To remove the print area, select Print_Area in the Define Name dialog box and click the Delete button. The next time you print, you'll get the entire worksheet.

Alternatively, you can use a simple keyboard procedure to explicitly define the whole worksheet as your print area. Press Ctrl-Home to move to cell A1. Then hold down the Shift key and press Ctrl-End to extend the selection to the lower-right corner of the populated area of your worksheet. After this, pull down the Options menu and choose Set Print Area.

You can remove print titles the same way you remove a print area. Choose the Define Name command, select the name Print_Titles, and click Delete.

- **UNDEFINE PRINT AREAS AND TITLES:** The Define Names dialog box gives you a one-command way to remove print area and title settings.
- **CENTERING TITLES ACROSS COLUMNS:** Let this interactive macro find the proper position for titles spanning multiple columns.
- **EXCEL SHORTCUTS:** These two timesaving tips let you enter formulas and call up workspace files more efficiently.

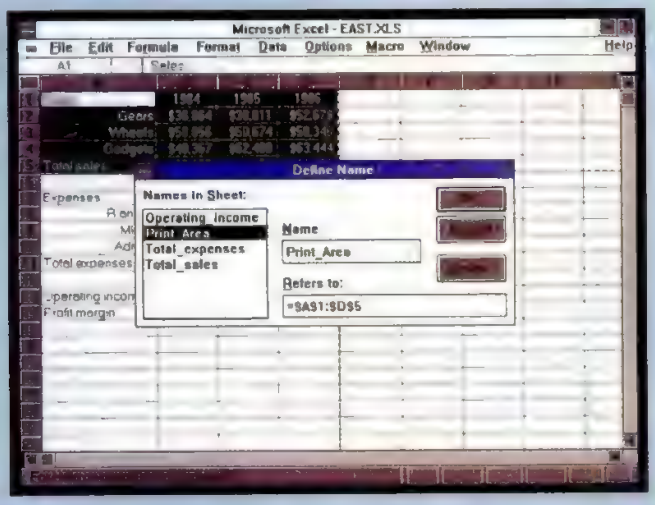

Figure 1: The Define Name Dialog box in *Microsoft Excel* 2.1 lets you delete or "undefine" a specified print area or print title.

CENTERING TITLES ACROSS COLUMNS

I often need to center titles across more than one column in *Lotus 1-2-3*. To do this, you can enter spaces in front of the title text until it appears centered. However, if you change the width of any of the titled columns, the title is no longer centered.

As an alternative, you can place the title text in a formula that automatically adjusts the leading spaces in response to any changes in column width. The formula

```
@REPEAT(" ",(@CELL("width",A4..A4)
+@CELL("width",B4..B4)-
@LENGTH("Text"))/2)&"Text"
```

will center the word `Text` over columns A and B. The formula uses @CELL ("width",A4) and @CELL("width",B4) to determine the width of the columns. The formula determines the number of spaces to insert before the title by adding the two column widths, subtracting the length of the title text, and dividing the result by 2; @REPEAT inserts the spaces before the text. If you want to center your heading over more than two columns, add @CELL functions for each additional column.

You might have difficulty typing this formula accurately, so I developed a macro to automate its creation. The macro, listed in Figure 2, prompts you for three pieces of information: the number of columns over which the title is to be centered, the title text, and the number of rows between the heading and a reference row.

To run the macro, place the cell pointer in the leftmost column of the range in which you want your title to appear. If you want your title centered across D1..G1, for ex-

CENTERING COLUMN WIDTHS — **COMPLETE LISTING**

```
     A                                    B
1          \c {WINDOWSOFF}
2             {GETNUMBER "Enter the number of columns the title will
              span:  ",columns}
3             {GETLABEL "Type the title:  ",title}
4             {GETNUMBER "How many rows down is the stationary reference
              row?  ",reference}
5             {INDICATE " Please Wait "}{RECALC down}{PANELOFF}
6        down {DOWN reference}
7             {FOR counter,1,columns,1,loop1}
8             {LEFT columns}{UP reference}
9             @REPEAT(" ",(
10            {FOR counter,1,columns-1,1,loop2}
11            {RECALC cellwidth}
12            @CELL("width",$col-1)-@LENGTH(
13                                                          ERR
14            {FOR counter,1,columns,1,deleteloop}
15            {INDICATE}{CALC}
16
17      loop1 {RECALC create}
18     create /RNCcol0~{BS}~
19            {RIGHT 1}
20
21      loop2 {RECALC cellwidth}
22  cellwidth @CELL("width",$col0)+
23
24  deleteloop {RECALC delete}
25      delete /RND{Esc}col0~
26
27     counter
28     columns
29    cellname col0
30       title
31   reference
```

Figure 2: This macro will center the text across a group of columns; it will center the text automatically, even when you change the column widths. Place the cursor in the far-left cell of the group of cells you want the title to span. The formula will prompt for the number of columns in the range, the text of the title, and the row to use as a reference (this avoids a circular reference error).

ample, put the cell pointer in D1. Then press Alt-C and answer the prompts. The first two prompts ask for the width of the title in columns and the title itself. The third prompt asks how many rows below the title to place the reference row.

To build the formula, the macro uses cells in the reference row as arguments for the formula's @CELL functions. This row can be anywhere on the worksheet, but it's best to choose a row—other than the one in which the title will appear—that you're sure you won't later delete. If you delete the reference row, the formula will return ERR. If you reference the heading row, the formula will produce a circular-reference warning. So, for example, if you're entering a heading in row 1 and you're sure you'll never delete row 2, you can specify 1 as the offset to the reference row.

The macro includes seven *dynamic* string formulas—in cells B9, B12, B13, B18, B22, B25, and B29. The listing in Figure 2 shows the macro statements that result from these formulas before the macro is run the first time. (Ignore the ERR value that appears in line 21; it will disappear when the macro is run.) During execution, the text strings produced by these formulas will change.

The string formulas are in Figure 3. Enter *these* in cells B17, B20 etc., rather than the results in Figure 2!

If you're using *Lotus 1-2-3*, Release 3.0 or 3.1, you must store this macro in the file in which it will be used. The {GETNUMBER} and {GETLABEL} commands in lines 10 to 12 will not work across two files, even if both are present in memory.

David E. Ritter
Douglassville, Pennsylvania

Users of *1-2-3*, Release 2.01, 2.2, and 3.0, should find this macro particularly handy. So should users of *Quattro Pro* and other spreadsheets that are patterned after *1-2-3* or that read *1-2-3* macros. All these programs normally make the creation of centered heads a painful enterprise.

If a left-aligned label is too wide for a *1-2-3* cell, *1-2-3* spills it out onto neighboring cells to the right, provided those cells are vacant. That's fine. What's awkward is that *1-2-3* does exactly the same thing with centered labels. Headlining would be a little easier if *1-2-3* spilled centered text out in both directions from the label cell, as *Microsoft Excel*, *Wingz*, and *Allways* do.

Even with centered text overflowing in both directions, though, positioning a headline over a block of data can be troublesome. That's because *Excel*, *Wingz*, and *Allways* use the middle of the cell that contains the label as the centering point. If that midpoint doesn't fall exactly in the middle of the data block, you need to monkey around with column widths to center the heading.

The most efficient way to specify the position of a centered heading is to name the end points of the interval that will contain the text. That is what Mr. Ritter's macro accomplishes. If your data block extends from column A to column F, simply tell the macro to center your heading between those columns.

(Centering between end points is a built-in feature of the WYSIWYG component of *1-2-3*, Release 3.1, and of *Impress*, an add-in for Release 2.*x*.)

One potential problem with Mr. Ritter's macro is that the formula it creates can become quite long. The more columns your heading spans, the longer the formula will be. At some point, you may run up against the 240-character formula limit of Release 2.*x* or even the 512-character limit of Release 3.

If you find yourself bumping into the

DYNAMIC STRING FORMULAS — **COMPLETE LISTING**

```
B9:    +"@REPEAT("" "",("
B12:   +"@CELL(""width"",$col"&@STRING(COUNTER-1,0)&")-@LENGTH("
B13:   +""""&@CELL("contents",TITLE)&""""))/2&""""&@CELL("contents",TITLE)&""""~"
B18:   +"/RNCcol"&@STRING(COUNTER,0)&"~{BS}~"
B22:   +"@CELL(""width"",$col"&@STRING(COUNTER,0)&")+"
B25:   +"/RND{ESC}col"&@STRING(COUNTER,0)&"~"
B29:   +"col"&@STRING(COUNTER,0)
```

Figure 3: When you type in the macro shown in Figure 2, you must replace the dynamic string formulas in cells B9, B12, B13, B18, B22, B25, and B29 with the formulas shown above.

limit, be sure your reference row has a single-digit number and try removing the dollar sign from the string formula in B20. Taking out that dollar sign will make the @CELL arguments relative instead of absolute, saving a few precious characters. If you aren't having formula-length problems, though, it's better to leave the references absolute. That way you can copy the formula to other parts of your worksheet more easily.

Mr. Ritter is right: Release 3 users must store this macro on the worksheet where it will be used. If you don't, {GETLABEL} and {GETNUMBER} will try to store your replies in the current sheet, rather than within the macro. Since the macro is designed to turn your replies into working macro statements, this misplacement will cause the macro to fail.

Users of *Quattro Pro*, on the other hand, can gloat. Their program is smart enough to put the {GETLABEL} and {GETNUMBER} responses on the macro's own worksheet, not the sheet on which the macro is run. If you're using this macro in *Quattro Pro*, be sure to install the *1-2-3*-compatible menu tree first.

EXCEL SHORTCUTS

I'd like to pass along two tips for *Microsoft Excel* users.

First, when entering a one-function formula, such as =SUM( ), omit the argument and press Enter twice. *Excel* will beep and leave you on the input line with the insertion point between the opening and closing parentheses. Then enter the argument by pointing with the mouse.

This may sound like a strange way to enter a formula, but it really saves steps. You can do all the keyboard entry in one step, and the mouse work in another. If you were to enter the formula in the customary way, you would have to type the function and opening parenthesis, pick up the mouse to point, then return to the keyboard to type the closing parenthesis.

My second tip concerns linked worksheets in a workspace file. You should give an alphabetically prior name to the file that contains the remote reference. That way, when you retrieve the workspace file, you won't get an "Update references to Unopened Documents?" message.

Rick Mance
Arlington, Texas

Typists will appreciate Mr. Mance's formula-entry tip. It really does simplify mixed keyboard and mouse entries. One additional wrinkle: If the beeping irritates you, turn it off. You can do that by pulling down *Excel*'s Control menu, choosing Run, and then choosing Control Panel. When Control Panel appears on your screen, double-click the Sound icon, remove the check from the Warning Beep check box and then click OK.

As for Mr. Mance's second tip, *Excel* displays the "Update references . . ." message any time you load a file containing one or more formulas that reference other documents not currently in memory. If you answer yes, the program finds the supporting documents on-disk and retrieves the latest value of each referenced cell. If you answer no, the referencing formulas retain the values they had the last time you saved them.

When you retrieve a workspace file, *Excel* loads the documents in alphabetical order. Suppose you have saved A.XLS and B.XLS together as WORKSPCE .XLW and that A.XLS contains a formula that references a cell in B.XLS. Then reloading WORKSPCE.XLW will cause *Excel* to display its update question—even though you've asked the program to load both .XLS files.

Heed Mr. Mance's advice and you can avoid the tiresome query. You can also ensure that a supporting document is loaded first, if you use an underscore as the first character of its name. The underscore will put the document's name alphabetically prior to any name beginning with a letter.

Note that if your workspace file contains a chart and its supporting worksheet, and if both have the same filename, then you will always get the update query on loading the workspace. That's because the .XLC (chart) file comes ahead of the .XLS (workspace) file in the alphabet.

Let's hope that Microsoft adds a little IQ to the workspace feature in its next revision of *Excel*.

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by
Craig L. Stark

The Working Word

A WORDPERFECT HIGHLIGHT

Double-checking a document on-screen against its hard-copy equivalent can be a pain in the neck. Your eyes often have problems following that little blinking cursor, and redefining the cursor's size doesn't help. I've always wanted to highlight a line at a time to help guide my eyes from paper to screen. The *WordPerfect* 5.0 macro that creates an accompanying Highlight Bar Macro lets me do just that. The code is shown in Figure 1.

The macro uses the block function to highlight the cursor's current line. The Up and Down Arrow keys move the highlight bar one line at a time; the Plus and Minus keys move the bar to the top or bottom of the screen; F1 (cancel) ends the macro.

The {CASE} function calls one of four cursor subroutines (Up, Down, Screenup, or Screendown) when you hit the proper key. These four subroutines first turn off block mode, reposition the cursor, and pass control back to the label **start**. At this point the macro turns the block back on and highlights the new line. If you press any key other than the specified four, the macro calls the idle subroutine, which turns off the block mode and returns to **start**. Thus the bar will blink and remain on the current line. When you hit F1, the {ON CANCEL}{GO} function calls the end subroutine, which turns off block mode and terminates the macro.

Note that the message "F1 to cancel" is pushed flush right on the prompt line by inserting spaces in the macro. Be careful not to space the message too far right, or the cursor will be forced to the next line, shortening your screen display by one line.

Harley W. Lond
Los Angeles, California

- **A WORDPERFECT HIGHLIGHT:** This *WordPerfect* 5.0 macro highlights your text one line at a time.
- **VIEWING KEY ASSIGNMENTS:** While you can go through several menus, this macro is faster and easier.

This HIGHLITE macro is certainly a boon to the eyes of any proofer. In the following paragraphs, Neil J. Rubenking offers a slight improvement to the already-fine macro code.

This macro will not work correctly if you invoke it when {Block} is turned on. The line

```
{IF}{STATE}&128~{Block}{END IF}
```

will fix it. If a block is marked, the expression {STATE}&128 will be nonzero, and any nonzero value is considered TRUE in {IF} tests. So, if a block is marked, this line turns it off. If no block is marked, it does nothing. Figure 2 is HIGHLIT2.WPM,

HIGHLITE.WPM

```
{ON CANCEL}{GO}end~~
{LABEL}start~
{Home}{Left}{Block}{End}
{CHAR}1~Highlight:···↑···↓···-·{Screen-up}····+·
{Screen-down}···............F1·to·cancel~

{CASE}{VAR 1}~
{Down}~down~
{Up}~up~
{Screen Down}~screendown~
{Screen Up}~screenup~
_
{CALL}idle~

{LABEL}down~
{Block}
{Down}
{GO}start~

{LABEL}up~
{Block}
{Up}
{GO}start~

{LABEL}screenup~
{Block}
{Screen Up}
{GO}start~

{LABEL}screendown~
{Block}
{Screen Down}
{GO}start~

{LABEL}idle~
{Block}
{GO}start~

{LABEL}end~
{Block}
{Home}{Left}
{QUIT}
```

Figure 1: This macro highlights your document one line at a time. Use it to compare a screen document with its hard copy version.

HIGHLIT2.WPM — COMPLETE LISTING

```
{IF}{STATE}&128~{Block}{END IF} {;}If·block·on,·turn·it·off~

{ON CANCEL}{GO}end~~

{LABEL}start~
                                {Home}{Left}{Block}{End}  {;}highlight·a·line~
                                {CHAR}1~Highlight:···↑···↓···-·{Screen-up}····+·
                                {Screen-down}···............F1·to·cancel~
                                {Block}
                                {CASE}{VAR 1}~
                                 {Down}~ok~
                                 {Up}~ok~
                                 {Screen Down}~ok~
                                 {Screen Up}~ok~
                                _
{GO}start~

{LABEL}ok~
                                {VAR 1} {;}key·ok,·execute·it~
{GO}start~

{LABEL}end~
                                {Block}
                                {Home}{Left}

{QUIT}
```

Figure 2: HIGHLIT2.WPM improves and streamlines the HIGHLITE macro shown in Figure 1. HIGHLIT2 lets you highlight your lines even if Block is turned on.

a streamlined version of HIGHLITE that incorporates this change.

Here's a tip if you use the macro to incorporate changes that have been penciled onto a printed copy of the document. Start at the *bottom* and work up. If you start at the top, each change will affect the lines below it and cause them not to match the printout. Starting at the bottom avoids this problem.

VIEWING KEY ASSIGNMENTS

The *WordPerfect* macro (shown in Figure 3) allows you to review the current keyboard assignments. Simply bring up the listing, scroll up or down to find the desired key redefinition, and then exit directly back to your document. The macro prevents you from viewing or inadvertently changing the macro code.

To view the current keyboard, press Alt-V. (You could also give the macro a longer name, store it as a .WPM file, and invoke it by that name using Alt-F10.) The macro then asks if you want to view the current keyboard. If you press y or Y, the Keyboard Editing screen with the current reassignments will be displayed. If you press any other key it will cause the macro to quit.

The macro then checks the state of *WordPerfect*. If you are not in the main editing screen when you invoke the macro, the EXIT command will not bring up a (Y/N) prompt. Consequently, the test for STATE &1024 will fail, you will be prompted to run the macro only from the main document, and the macro will terminate.

If you *are* in the main editing screen, the state test will not fail, the (Y/N) prompt will be canceled, and the Keyboard Editing screen will be displayed. Pressing the Up or Down Arrow keys now will move the cursor bar one line at a time in the desired direction, so you can scroll through all key-reassignment descriptions and corresponding key macro numbers.

The PROMPT prevents the display of the usual key and macro options (Edit, Create, Move, Delete, Save, and Retrieve). Instead, the loop generates the message "Press Up or Down to view. Press F7 to Exit" in order to remain on the Keyboard Editing screen. The keyboard-scanning Look statement prevents you from viewing or inadvertently changing the key reassignment (or macro) code itself.

ALTV.WPM — **COMPLETE LISTING**

```
{;}    Test·current·state·for·main·document·only~
{;}    If·4-bit·of·state ·is·set,·continue~
{;}    Otherwise·display·message·and·quit~
{IF} {STATE}64~{BREAK}
{ELSE}
    {PROMPT}Invoke·this·macro·only·from·main ·document~
    {WAIT}15~{DISPLAY OFF}{DISPLAY ON}
    {QUIT}
 {END IF}

{;}If·operator·answers·Y·or·y,·continue;·otherwise·quit.~
 {CHAR}1~View·current·keyboard?·(Y/N):··~
{IF}"{VAR 1}"="y"~{BREAK}
 {ELSE}
{IF}"{VAR 1}"="Y"~{BREAK}
{ELSE}{DISPLAY OFF}{DISPLAY ON} {QUIT}
{END IF}{END IF}

{;}Turn·cancel·off·so·only·Exit·is·valid~
 {CANCEL OFF}
{SETUP}ke

{;}Set·value·of·variable·1·to·empty~
{ASSIGN}1""
 {PROMPT}Press·<Up>·or·<Down>·to·view.··Press·<F7>·to·exit.~

{;}Evaluate ·every·character·that·is·typed.~

{;}If·<Enter>·typed·then·execute ·the·EXIT·subroutine,·~
{;}···return·from·it·and·break·out·of·the·look ·loop~

{;}If·<Up>·typed·go·up·and·continue·to·look·at·keystokes.~

 {;}If·<Down>·typed·go·down·and·continue·to·look·at·keystrokes.~

{;}Ignore
·all·other·keystrokes,·but·continue·to·look·at·keystrokes.~

 {LABEL}loop~
{LOOK}1~
{IF}"{VAR 1}"="{EXIT}"~{CALL}exit~{BREAK}
 {ELSE}
{IF}"{VAR 1}"="{Up}"~{Up}{GO}loop~
{ELSE}
{IF}"{VAR 1}"=" {Down}"~{Down}{GO}loop~
{ELSE}{GO}loop~
{END IF}{END IF}{END IF}

{;}Operator ·returned·to·main·editing·screen.~
{;}End·of·macro·displayed.~

 {DISPLAY OFF}{DISPLAY ON}
{PROMPT}Macro·playback·is·finished~
{WAIT}5~ {DISPLAY OFF}{DISPLAY ON}
{QUIT}

{LABEL}exit~
{DISPLAY OFF}{EXIT}s@
 {RETURN}

*** end of macro ***
```

Figure 3: You can call this handy macro from anywhere in your document to get a listing of your macro-key assignments.

Since Cancel has been turned off, only the Exit key ends the loop. Pressing the Exit key runs the subroutine labeled Exit at the end of the macro. This subroutine exits the current screen, selects the current keyboard, leaves the Setup screen (using menu option 0), and returns you to the point in the document from which it was called. The BREAK instruction after the CALL statement causes the macro to leave the loop. A prompt lasting .5 second informs you that the macro is finished and the screen display is updated.

Thomas R. van Deusen
San Francisco, California

Although the macro can run as is in both *WordPerfect* 5.0 and 5.1, the program printed here reflects two changes to Mr. van Deusen's original submission. First, the macro now checks the state of the keyboard to make sure that you are at the main editing screen *before* it asks if you want to view the current keyboard. Second, since the 4th bit is set whenever you are at the main editing screen, the macro now uses the value 4 instead of 1,024 with the State variable.

One final note: The function of the Look statement in this macro is really to look at the keystrokes coming from the keyboard. If the key is an Up or Down Arrow, the macro executes the key. If it is Exit (F7), it jumps to the exit routine. It "swallows" any other keystrokes.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing tips; we'll pay $50 for tips we print. Send your letter on a disk, along with a printout, to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for instructions). ■

by
Neil J. Rubenking

User-to-User

TAKING COMMAND

By now, everyone knows that to increase the environment size for COMMAND .COM, you need a line in your CONFIG.SYS file such as

```
SHELL=C:\COMMAND.COM /P /E:200
```

I've discovered a few other interesting options for COMMAND.COM, which make life a little easier. First, COMMAND.COM doesn't need to be in the root directory. In fact, the only two files that need to be in there are AUTOEXEC.BAT and CONFIG.SYS. Moving COMMAND.COM makes sense, especially if you're worried about viruses that usually assume COMMAND.COM is in the root directory. It also unclutters your root directory.

Let's say that you put COMMAND.COM with all the other DOS programs in a directory called \DOS. The shell line in CONFIG.SYS would then be

```
SHELL=C:\DOS\COMMAND.COM C:\DOS /P
 /E:200
```

You should note that there is a second C:\DOS on the command line. Without this, you'd need to instruct DOS where to reload COMMAND.COM from. Setting the COMSPEC environment variable to C:\DOS in your AUTOEXEC file accomplishes the same thing, but it requires more work. If COMMAND.COM is the only executable program in the root directory, you can also remove C:\ from your path.

Another interesting parameter to SHELL allows you to specify the I/O device at start-up. You do this by putting the device name at the end of the SHELL line. You can specify any character device. For instance, putting NUL on the SHELL line tells COMMAND.COM to use the NUL device as the initial I/O device, instead of the regular console (CON) device. Note: this means anything that would normally appear on the screen is redirected to the NUL device, so it doesn't appear. In DOS versions before 3.3, this eliminates the annoying ECHO OFF line that appears on the screen every time you boot your machine. The real advantage is that you prevent anyone from Ctrl-Breaking out of your AUTOEXEC.BAT file. Just be absolutely sure to include the CTTY CON command before the end of your AUTOEXEC.

- TAKING COMMAND: Here are some COMMAND.COM options for CONFIG.SYS.
- DO IT TODAY: Another way to get the current date into an environment variable.
- SAVING SPACE: Save disk space by storing your programs in compressed form.

CTTY CON tells COMMAND.COM to use the regular console device (your screen), instead of the null device. Any commands you want to be visible to the user should appear after the CTTY CON line.

Geoff Walsh
Beverly Hills, California

The /E:### switch to set the environment size works only with DOS 3.1 and later, but the other parameters mentioned here are good for any version of DOS from 2.0 on. You can place your COMMAND.COM in a subdirectory and you can choose the initial I/O device even if you don't use the latest DOS version. Don't forget the /P switch—it's a necessity.

Switching I/O to NUL doesn't eliminate *all* screen output, nor does it disable *all* keyboard input. If a program writes to the DOS Standard Output device, you won't see it on the screen. But many programs use direct video RAM output, and these will be visible. A program that gets user input via DOS standard input will be "disconnected," but one that takes input using the DOS keyboard services won't. Still, putting NUL on the SHELL line in CONFIG.SYS is much more effective than using CTTY NUL within your AUTOEXEC.BAT.

DO IT TODAY

In your August 1989 column, a reader described a way to use EDLIN to convert an environment variable TODAY to MM-DD-YY format. As you noted, using EDLIN with batch files is a great idea. However, you really don't need EDLIN at all. Here's a batch file, TODAY.BAT (Figure 1), that's much smarter and quicker.

First, the batch file copies itself in order to refresh its date-time stamp. It then stores a DIR listing of itself in a temporary batch file and calls that the temporary file. The temporary file in turn calls TODAY.BAT once again, but this time with the actual date as the third parameter.

Of course, you have to adjust the directory to where your batch file is stored, but this shouldn't be a problem. You just have to replace the specified path C:\BAT with your individual path.

Victor V. Terber
Frieburg, West Germany

I stuck one more line in the batch file to put the current time into an environment variable called NOW. If you don't need it or just don't want it, simply delete the line or add the word REM at the beginning.

TODAY.BAT uses the COPY command to update its own file date and time. The line

```
COPY /B C:\BAT\TODAY.BAT+,,
```

has the effect of concatenating TODAY .BAT with nothing and writing the result to TODAY.BAT. The contents of this newly copied file are unchanged, but its directory entry now has the *current* date and

TODAY.BAT — **COMPLETE LISTING**

```
@ECHO OFF
REM Batch to get the environment variable TODAY and NOW
REM in the DIR-format, e.g. " 7-20-89" and "1:07p"
IF NOT %4.==. GOTO label
COPY /B C:\BAT\TODAY.BAT+,, > NUL
DIR C:\BAT\TODAY.BAT | FIND "TODAY" > TEMP.BAT
TEMP.BAT
:label
SET today=%3
SET now=%4
DEL TEMP.BAT
```

Figure 1: TODAY.BAT is a batch file that puts the current date and time into environment variables—in the same format that the DIR command uses.

time. When you pipe the output of

```
DIR C:\BAT\TODAY.BAT
```

through the FIND filter, you strip out everything but the line that contains TODAY. That line gets written to TEMP .BAT, which then looks something like this:

```
TODAY  BAT    276  10-12-89  9:45a
```

Running TEMP calls TODAY again, but this time today's date is the third command-line parameter, and the current time is the fourth.

SAVING SPACE

I needed to find an efficient way to save valuable space on my hard disk, but copying frequently used programs from floppy disks takes too much time, and restoring them from a backup disk is certainly a hassle. So, instead I use DO.BAT (Figure 2) to compress files when they aren't needed and to expand them again when I want to use them.

To set up a particular program, first I configure the files to run on my system. Next, using *PKZIP*, I compress the files as much as possible, sometimes saving as much as half the original size, and then I move the compressed files to a directory named \ZIPPED.

DO.BAT — **COMPLETE LISTING**

```
@ECHO OFF
CD \ZIPPED\UNZIPPED
PKUNZIP \ZIPPED\%1.ZIP
%2 %3 %4 %5 %6 %7 %8 %9
CLS
CD \ZIPPED\UNZIPPED
PKZIP -a \ZIPPED\%1.ZIP *.*
ECHO Y | MORE | DEL \ZIPPED\UNZIPPED
```

Figure 2: Keep program files in compressed form and run them with DO.BAT.

To execute a zipped file, I type DO *Param1 Param2*, where Param1 is the name I gave to the compressed file and Param2 is the name of the file that executes the program.

For example, DO GAME1 RUNGAME first expands GAME1.ZIP and then calls the RUNGAME program to execute it. Here's how it works. The batch routine changes to the directory \ZIPPED\UNZIPPED. It expands the file GAME1.ZIP from the directory \ZIPPED to the current directory (\ZIPPED\UNZIPPED) and then executes the program RUNGAME. When the program terminates, DO.BAT automatically erases the expanded files from the hard disk. Be careful, because any files you have created or changed during the execution of the program will be lost. If your software allows, configure it to store work files in a different directory.

This method gives me more space on my hard disk, and because there are fewer files scattered around, helps keep the drive optimized.

Steve Muskovin
Coal City, Illinois

Parkinson's Law states that work expands to fill the time allotted. A corollary to this is that files expand to fill a hard disk's space. No matter how big your disk is, eventually you'll feel the crunch. By keeping your programs in compressed form on the hard disk, you do save disk space, but remember that it's at the expense of *substantially* increasing loading time.

There are a number of popular compression programs. *PKZIP*, mentioned here, is just one. You can use *ARC*, *LHARC*, or whatever compression program you prefer. If you don't have a utility for this purpose, download one from PC MagNet (instructions for accessing PC MagNet are on page 8).

Naturally, you'll want to empty the UNZIPPED directory after finishing with the program, but you don't have to risk accidentally deleting your work. I modified DO.BAT so that before deleting the files, it recompresses them into the ZIP file. You won't lose any data files now!

However, compressing all the files after using each program wastes even more time. DO2.BAT (Figure 3) shows how you can save some of that time—it compresses only new or modified files. Immediately after expanding the compressed file, it marks all the resulting files as *not* modified, using the command ATTRIB -A *.*. After running the program, DO2 uses XCOPY with the /M switch to copy only *modified* files to the TEMP directory. It deletes all the files in UNZIPPED, compresses the files in TEMP, and then clears TEMP. This method combines the best of both worlds—it doesn't waste time and doesn't lose the work you've done. You should note that some compression utilities can be told to delete files automatically after compressing them, and some have an option to compress only modified files. If your utility has these options, then you can use them to streamline DO.BAT even further.

DO2.BAT — **COMPLETE LISTING**

```
@ECHO OFF
CD \ZIPPED\UNZIPPED
PKUNZIP \ZIPPED\%1.ZIP
ATTRIB -A *.*
%2 %3 %4 %5 %6 %7 %8 %9
CLS
CD \ZIPPED\UNZIPPED
IF NOT EXIST TEMP\NUL MD TEMP
XCOPY *.* TEMP /M
ECHO Y | MORE | DEL *.*
CD TEMP
ECHO Compressing modified files
PKZIP -a \ZIPPED\%1.ZIP *.*
ECHO Y | MORE | DEL *.*
```

Figure 3: Speed up DO.BAT (Figure 1) by only compressing new or modified files.

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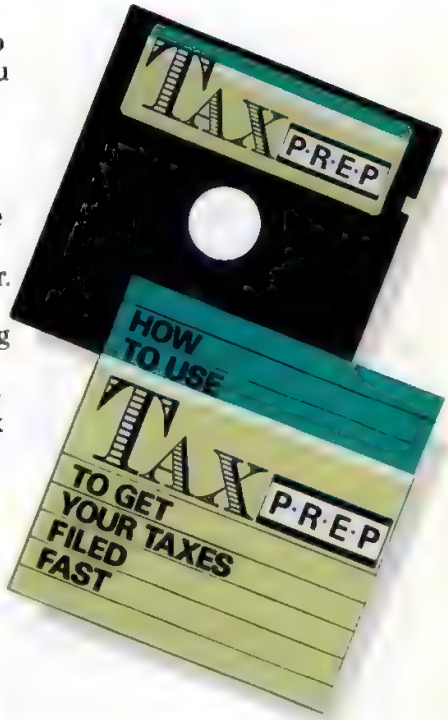

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CIRCLE 497 ON READER SERVICE CARD

by
Jeff Prosise

Tutor

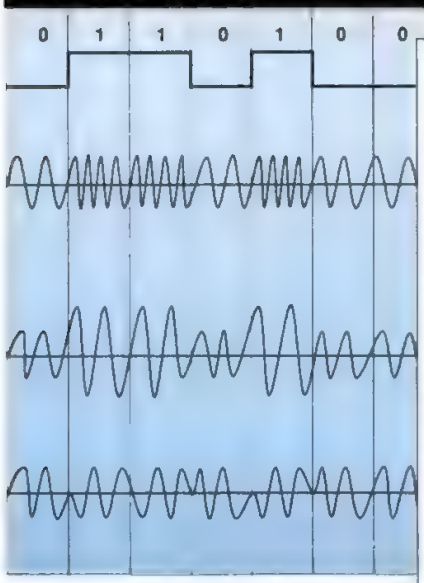
BAUD VS. BPS

I frequently hear the terms *baud* and *bps* used interchangeably, and I also hear that such usage is incorrect. Is there a difference between baud and bps?

Alison Engel
New York, New York

Baud and bits per second (bps) are not the same—at least not in the data rates commonly used today in serial communications. *Bits per second* is a measure of how many data bits are being transmitted over a communications channel every second. Recall that in serial communications, bytes are broken into bits before they're transmitted, placed on the line, and reassembled as bytes on the receiving end.

MODULATION AND THE PROPERTIES OF A WAVE



Bit pattern (binary 0110100 = decimal 52)

Frequency shift keying represents 1s and 0s by altering the frequency of the signal. One frequency represents 0, while another represents 1.

Amplitude shift keying leaves the frequency the same but varies the amplitude of the signal to transmit 0s and 1s.

Phase shift keying varies the phase of the signal rather than the amplitude or frequency. This pattern illustrates two-level PSK, where two phases 180 degrees apart are used to represent 0s and 1s.

Figure 1: A carrier signal is a sinusoidal waveform that, by itself, conveys no information. But sine waves have three defining properties, amplitude, frequency, and phase, that can be manipulated to represent data.

■ **BAUD VS. BPS: The two terms are *not* interchangeable.**

Baud (named after Jean Maurice Emile Baudot, an officer in the French Telegraph Service who is credited with devising the first uniform-length 5-bit code for characters of the alphabet in the late 19th century) refers to *modulation rate*: the number of times the line changes state every second. This means that at 300 baud the modem changes the signal it's transmitting every 1/300 of a second. The *state* of the line refers to *amplitude, frequency,* and *phase*, terms that I'll explain below. People who work at modem companies use it to avoid saying *amplitude, frequency,* or *phase* every time.

The difference between baud and bps is a result of the different forms of modulation used to encode digital data into analog waveforms. At 300-bps transmission rates, bps and baud are the same: Modems use a simple modulation method known as *frequency shift keying* (FSK) to place bits on the line. FSK varies the frequency of the analog telephone line signal to transmit digital 1s and 0s, using one frequency to represent 1s and another to represent 0s. FSK offers a much more reliable means of transmitting data than *amplitude shift keying*, which varies signal amplitudes rather than frequencies and is therefore more susceptible to line noise.

The important point to note is that in FSK modulation, there is a 1:1 relationship between transmitted bits and frequency shifts. One state change, or baud (the shift from frequency 1 to frequency 2 or vice versa) in the line corresponds to precisely 1 bit of transmitted data. Therefore, because FSK is used in 300-bps transmission, the terms baud and bps can be used interchangeably.

Data rates above 300 bps present a problem, however. The limited bandwidth of the communications medium (the public telephone system) restricts the modulation rate to about 1,200 baud using FSK (remember, a baud is a change of state; in this case, a baud is the shift from one frequency to another).

If the ratio of bits to bauds were limited to 1:1, data would be similarly limited. In order to achieve higher bit rates, modems forsake the FSK method for other forms of modulation, where 1 baud represents more than 1 bit of data and has more than two states. The Hayes Smartmodem 1200, for example, operates at 600 baud but uses a technique known as *quadrature phase shift keying* (QPSK) to achieve 1,200-bps data rates by transmitting 2 bits of information with each change in the state of the line.

How does QPSK work? A sinusoidal waveform has three defining properties: amplitude, frequency, and phase. Amplitude is the height of the wave; frequency is determined by the distance between waves; and phase is the temporal position of the wave relative to some fixed reference point. These properties are illustrated in Figure 1.

FSK represents binary 1s and 0s by changing the frequency of the signal; QPSK works by changing the phase. QPSK represents combinations of 2 bits—00, 01, 10, or 11—with signals shifted differentially out of phase with each other by 0, 90, 180, or 270 degrees. In effect, each

change in the line represents 2 bits.

The result: a data rate that's twice the baud rate and a means of encoding digital data that's compatible with conventional analog phone lines.

Other modulation methods yield even higher data rates. The Smartmodem 2400 uses a technique called *quadrature amplitude modulation* (QAM) defined in *CCITT* V.22bis to encode 4 data bits into every baud. (CCITT is a French acronym which translates to International Consultative Committee for Telephone and Telegraph; *bis* is also French and indicates a second version of a specification.) QAM combines aspects of both amplitude and phase modulation, employing 12 different phase angles and three different amplitudes to produce enough phase/amplitude combinations to represent the 16 different values that 4 randomly selected bits of data can take on.

This is shown in Figure 2. With QAM, modems can achieve a 2,400-bps data rate, while maintaining a relatively conservative 600-baud rate.

Today's V.32-compliant 9,600-bps modems use a QAM encoding method similar to the one outlined in V.22bis. (See Figure 3 for a description of the current data communications standards.) Two transmission modes are defined: *trellis-coded* and *nontrellis-coded*, both of which operate at 2,400 baud. It's possible to operate at 2,400 baud over conventional telephone lines, because frequency shift keying is *not* used (with FSK, remember, that the highest baud rate possible is 1,200).

In the nontrellis coding scheme, modems encode 4 bits per baud to achieve 9,600 bps. Trellis coding, on the other hand, increases the modem's resistance to line noise by doubling the number of phase and amplitude combinations from 16 to 32. With this scheme, 5 bits can be transmitted with each baud. Four bits are used for data, while the fifth permits a 9,600-bps V.32 modem to tolerate more line noise than one that doesn't use trellis coding by providing higher separation between phase/amplitude signal combinations.

Error-control and data compression schemes can increase data throughput levels even more. For example, a 9,600-bps V.32 modem employing V.42 error control can transmit at an effective rate of 11,700 bps by stripping the start and stop bits off each character on the sending end and restoring them on the receiving end. V.42 is not a zero-overhead protocol, and some of the extra bits are used to carry error-control information. But it does use fewer bits for error checking, making more bits available for data.

The same modem with V.42bis data compression can achieve up to 38,400 bps by encoding character strings into code words and deciphering them on the receiving end.

The moral of the story: The more sophisticated the encoding scheme, the more distant the relationship between baud and bps. So for technical accuracy, data transmission rates should be referred to in bits per second.

DATA COMMUNICATIONS STANDARDS

Standard	Description
V.14	Transmission of asynchronous characters with synchronous modems.
V.21	0- to 300-bps full-duplex modulation.
V.22	1,200-bps full-duplex modulation.
V.22bis	2,400-bps full-duplex modulation.
V.23	600- and 1,200-bps half-duplex modulation with 75-bps reverse channel.
V.24	Interchange circuit definitions (similar to EIA RS-232).
V.26ter	2,400-bps full-duplex modulation (used primarily in France).
V.27ter	2,400- and 4,800-bps half-duplex modulation (used in Group III fax).
V.28	Interchange circuit electrical characteristics (similar to EIA RS-232).
V.29	4,800-, 7,200-, and 9,600-bps half-duplex modulation (used in Group III fax).
V.32	4,800- and 9,600-bps full-duplex modulation.
V.32bis	4,800-, 7,200-, 9,600-, 12,000-, and 14,400-bps full-duplex modulation with rapid rate renegotiation.
V.42	Error control for full-duplex modems that use async-to-sync conversion (V.22, V.22bis, V.26ter, and V.32). Includes Alternative Protocol for compatibility with modems incorporating MNP-2 through MNP-4, and falls back to V.14 for compatibility with modems that do not implement error control.
V.42bis	Data compression for V.42 modems. Using Lempel-Ziv compression techniques, V.42bis can increase throughput over V.42 by as much as 4 to 1.
V.54	Loop test devices for modems.
V.56	Comparative tests for modems.

Figure 3: These standards specify various aspects of modem data communications.

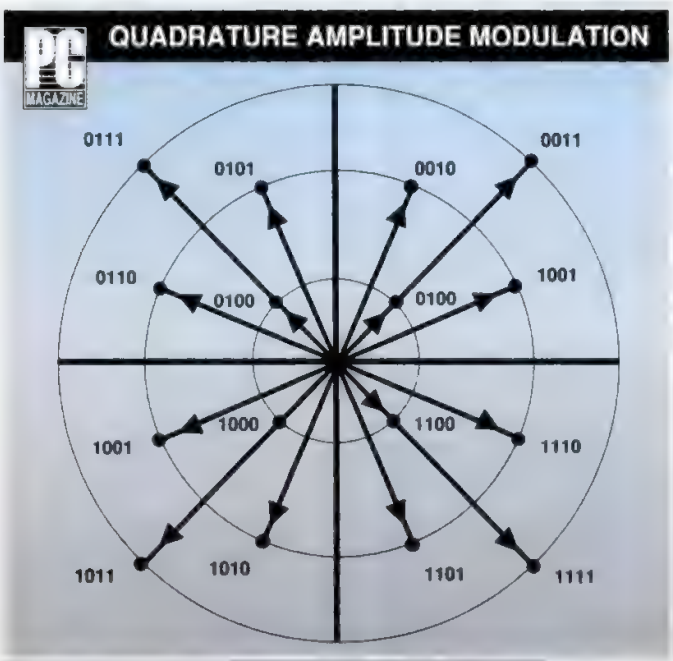
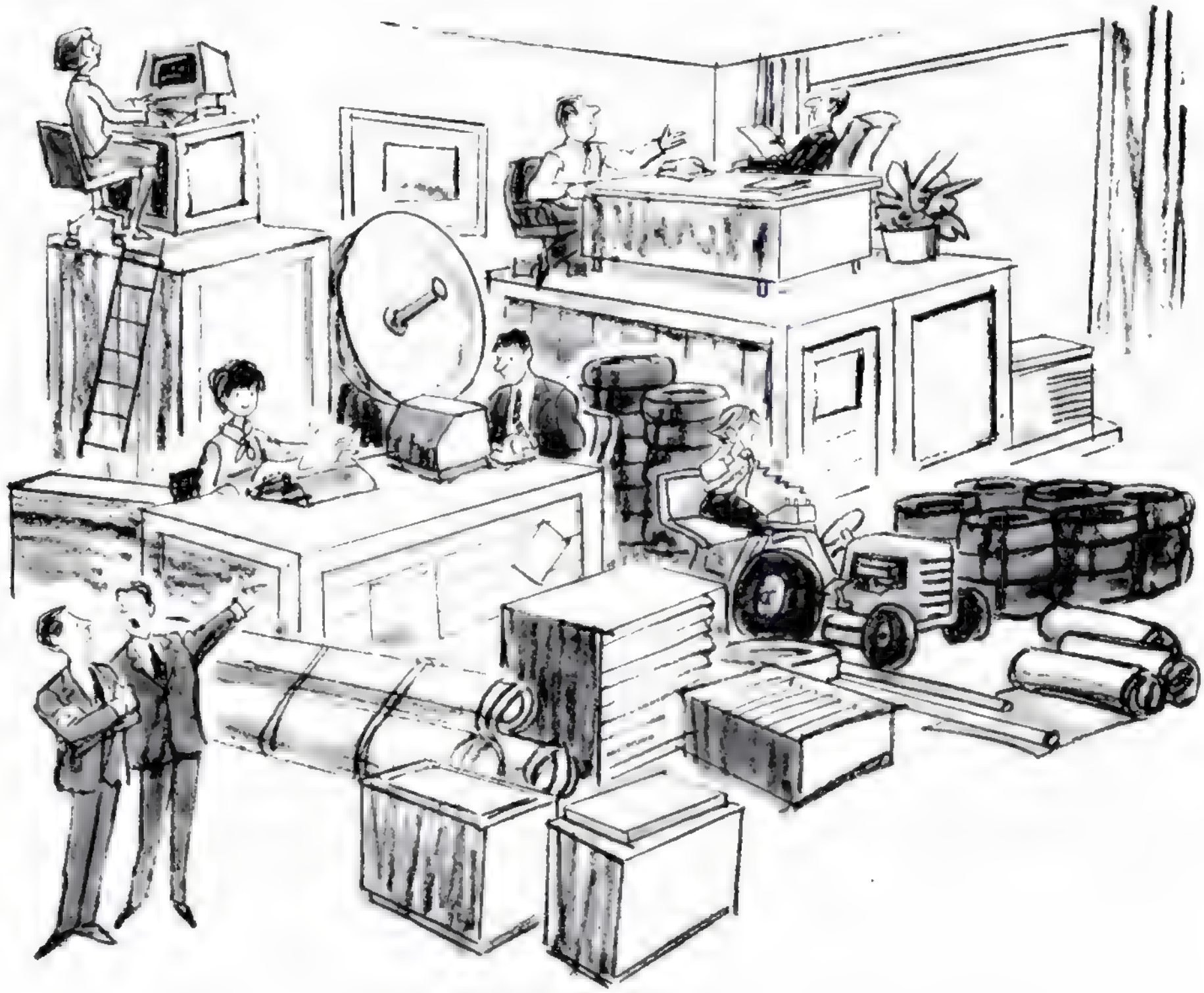


Figure 2: Quadrature Amplitude Modulation (QAM) produces 16 signal states from a combination of 12 angles and 3 amplitude levels.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. To have your questions answered in this column, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access instructions). We regret that we are unable to answer questions on an individual basis. ■



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Frank J. Derfler, Jr.

Connectivity

PUTTING IT ALL TOGETHER

I manage a 220-node network using ARCnet and five *NetWare 286* servers. We have seven PCs dedicated to tasks like acting as a print server, communicating with our IBM mainframes over SNA lines, and acting as remote-control stations for users calling in. Is there a good way to combine some of these functions and get rid of the standalone PCs?

James Crozier
Chicago, Illinois

Several companies provide a way to combine your print, communications, and even file servers into a single cabinet. They place a CPU with its associated memory on a single board and let you put several of these boards in one cabinet.

Don't confuse this multiple CPU approach with the multiprocessing architecture used in the Compaq Systempro and in so-called superservers from other companies. Those multiprocessing servers need special software that can divide the activity between the processors millisecond-by-millisecond.

With the approach I'm discussing, you construct a system of multiple CPUs but dedicate each processor to a general task. This configuration provides the equivalent of multiple PCs in a single cabinet.

MaCo Networks (803-278-7225) sells a series of products allowing a combination of server functions in a single box. Prices start at about $3,995 for a single CPU in a rackmount enclosure with a huge amount of space for expansion. You should also check out two competing companies, Cubix Corp. (702-883-7611) and J&L Information Systems (818-709-1778).

SHARING A DATABASE

I'm running a database application on a PC-XT clone. I'd like to attach a terminal in a different building approximately 1,500 feet away. The environment the terminal will be in is hot, humid, and full of smoke (a kitchen), and I'm afraid a PC won't last too long in that area. What's the best and cheapest way to hook it up?

Ephraim Ruvel
(via MCI Mail)

You want the best and cheapest way to time-share an XT clone over more than 1,500 feet of wire? Well, I'm not sure you'll be happy with the response time from a shared XT, but it can be done. The Software Link's *PC-MOS* is a multiuser operating system that will work on your PC-XT. This software uses DOS applications, but allows multiuser access to files—including access by terminals of many kinds attached through the RS-232C port. The five-user version of *PC-MOS* carries a list price of $595. Call the Software Link at (404) 448-5465 for more information.

Keep in mind that if you want to update or modify the same data files from both locations, you'll also need a multiuser version of your database program.

You can solve the distance problem with a call to Black Box Corp. (412-746-5565). Say you're interested in a *line driver* for RS-232C asynchronous operation. A *line driver* multiplexes RS-232C signals over four wires and adds the punch needed to carry the signals for a couple of miles. You'll need two line drivers at about $85 each, as well as two pairs of wire to run between the locations.

ARCNET ENIGMA

I run a network of over 50 nodes, using ARCnet adapters with Novell's *Advanced NetWare 286* operating system. We have a variety of client PCs and several types of ARCnet adapters, and we've got one problem that's stumped us.

The network runs fine until we try to connect a Zenith 386/16. The minute we attach that computer to the network, the whole system crashes. There are several similar Zeniths on the network, and they all work well. I've swapped every card from the new Zenith—even the disk controller card—and they all work in other machines. And the Zenith works fine as a standalone PC. But when we put this machine on the network, it drags everything down. What could be happening?

Patrick Tan
Memphis, Georgia

We called on the responsive and respected folks at Performance Technology to help tackle this mystery. Some of the people at Performance Technology assisted at the birth of ARCnet, and the company has a reputation for satisfied customers.

The day after we got Performance Technology involved, we received a six-page analysis. Both the suspected and the actual causes are interesting.

At first, Performance Technology's technical support people were sure the problem was an out-of-specification power supply in the offending machine. ARCnet adapters typically use the PC's +5 volt power supply to transmit signals on the

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coaxial cable. A bit transmitted on the cable consists of a +10 volt pulse followed by a -10 volt pulse generated from the +5 volt supply.

An ARCnet receiver needs a reference voltage to evaluate the pulses on the cable. On almost every ARCnet adapter, you'll see an epoxy-coated circuit board known as the *hybrid*. If the hybrid can't see a reference voltage, the adapter will be able to transmit on the network, but not receive. This situation brings down a network because if an ARCnet board doesn't hear a token pass for 840 milliseconds, it sends out a message to reconfigure along with tokens. And this process destroys all other network traffic. Jabbering adapters are a common vulnerability of any broadcast network, including Ethernet.

But the sleuths were stumped themselves when the power supply in the Zenith PC turned out to be fine. Finally, after further investigation, they determined that the source of the problem was an improper mixing of bus and star topologies on the ARCnet network.

The original ARCnet system was designed to use only a star topology with all nodes attached to a hub using RG-62 coaxial cable. This system has proven its reliablity in thousands of nodes throughout the world.

Two years ago, Standard Microsystems introduced a variation of ARCnet that allowed the use of a daisy-chain wiring topology with T-connectors at each node, like thin Ethernet. This topology reduces the number of hubs and saves money.

Finally, several manufacturers introduced versions of ARCnet using unshielded twisted-pair wiring. Unlike the original ARCnet coaxial system in a star topology, there's little guarantee of compatibility between different vendors' adapters in a daisy-chained twisted-pair environment.

Once a problem occurs on a network, the star topology turns out to be the easiest to troubleshoot as well as the least likely to interrupt the entire network. Synoptics, one of the leaders in the field of LAN cabling, markets a star-wired thin Ethernet system for just this reason.

The network Mr. Tan manages has a combination of every possible ARCnet topology and wiring plan, including twisted-pair wiring with *baluns* (small devices that convert the impedance of coaxial cable so that its signal can run on twisted-pair wiring). While the exact cause of the outage still isn't clear, it's likely that adding the PC at that particular point in the network broke the camel's back by lowering the signal level to such a degree that all the machines on that leg went "deaf" and broadcast reconfiguration messages with tokens.

But the investigation did make two lessons absolutely clear. First, a star topology in any kind of network has significant advantages when the troubleshooting starts. Second, a well-designed cabling scheme is critical to reliable performance.

> A star topology in any kind of network has significant advantages when the trouble-shooting starts.

Unshielded twisted-pair wire isn't necessarily good or bad in any network scheme, but it must be carefully installed. There are great differences in the quality of the wire and particularly in the quality of the connection blocks used to link the wire runs together in the wiring closet.

WINDOWS AND LANS

We received *Microsoft Windows* 3.0 with our new PCs. Can we use *Windows* on our networked PCs?

Wyden Gordon
Dallas, Texas

Microsoft designed *Windows* 3.0 to be compatible with networks, so in theory you should have no problem. But we have heard stories about large files getting garbled when they move from a *Windows* application across a network running under *SFT NetWare 286*. And many users report dissatisfaction with the performance of *Windows* and network client software running on PCs with 80286 processors.

I play it safe using *DESQview* for my multitasking environment, but others in the LAN Labs do use *Windows* successfully, with both Microsoft's *LAN Manager* and *NetWare 386*.

If you plan to use *Windows* with *NetWare*, you'll need Version 3.01 of the *NetWare* DOS shell and the latest updated utilities for *Windows*. You can download the entire *NetWare DOS/Windows Workstation Upgrade Kit* from the NetWire forum on CompuServe. But if you don't want to spend the two hours needed to capture all the files at 2,400 bits per second, call Novell at 800-346-7177. The part number for the $30 kit is 883-001077-001 for 5.25-inch media and 883-001078-001 for 3.5-inch diskettes.

You should also have the latest version of the driver software for the network adapters you use. Check with the manufacturer of the adapters—not Novell—for the latest version. Often you can download this software from a manufacturer's bulletin board. Driver software can make a great difference in performance and reliability.

Windows users should know about *Windows Workstation* by Automated Design Systems in Atlanta (404-394-2552). This product is really a group of utilities that work in the background, helping PCs to work with *NetWare* and *LAN Manager* servers.

With *Windows Workstation*, you can gather statistics on how often people use applications, provide password protection and file encryption for individual workstations, create scripts to automate log-on and resource assignments, and create menus of resources you can centrally update.

The product also improves the ability to control print jobs and the print queue. Users can receive automatic notification when print jobs finish, select printers from a descriptive menu, as well as view a map of printer locations that they can create.

Windows Workstation costs $695 for ten users. If your organization runs *Windows*, both system administrators and end users will like its features.

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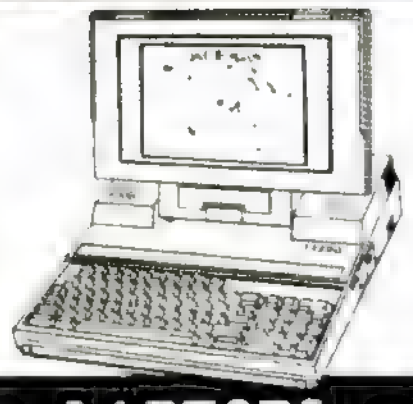

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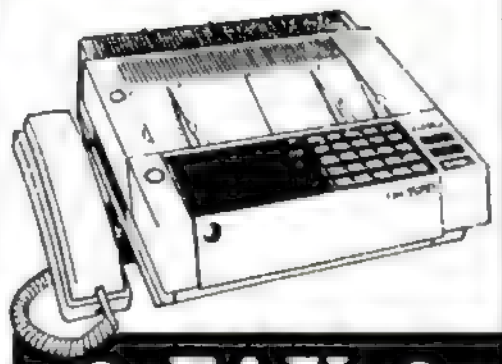

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- ✓ Standard chassis with keylock, and speed and reset buttons. (Optional chassis add $50)
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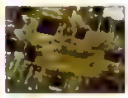

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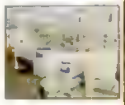

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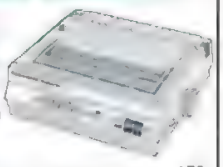

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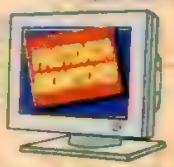

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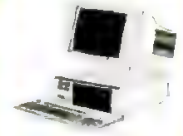

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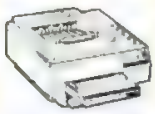

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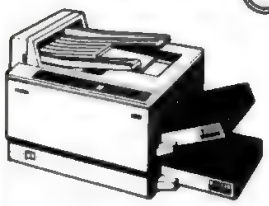

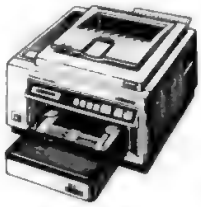

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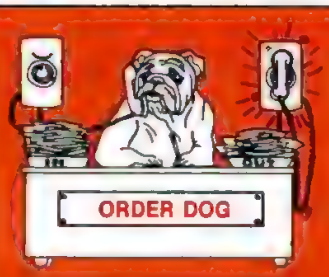

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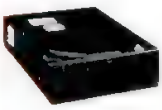

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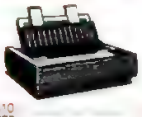

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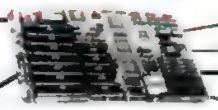

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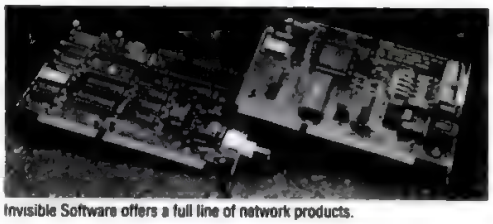

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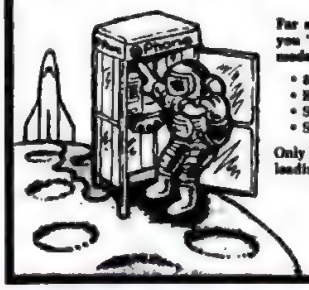

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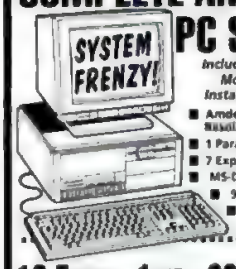

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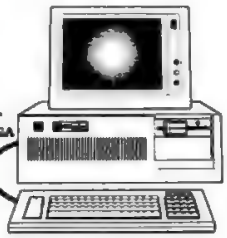

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02. ☐ Manufacturer—Aerospace
03. ☐ Manufacturer—Other
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12. ☐ Research and Development
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17. ☐ Non-Computer Retailer/Distributor
18. ☐ Other Business or Service
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14. ☐ Admin./Mgmt.
99. ☐ Other

4. Is your company a reseller?
01. ☐ Yes
02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01. ☐ 10 or less
02 ☐ 11-25
03. ☐ 26-99
04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01. ☐ Linked to mainframe
02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh

8. Do you plan to buy any PC Products?
01. ☐ Now
02. ☐ In 4 to 6 months
03. ☐ In 7 to 12 months
04. ☐ No definite plans

9. Number of Employees in your entire company:
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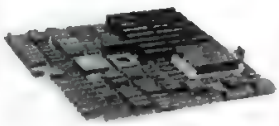

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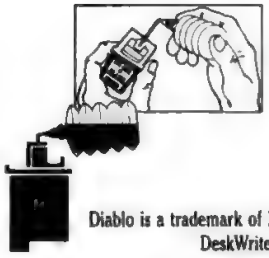

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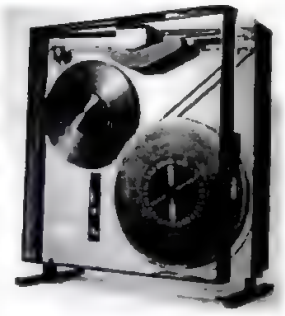

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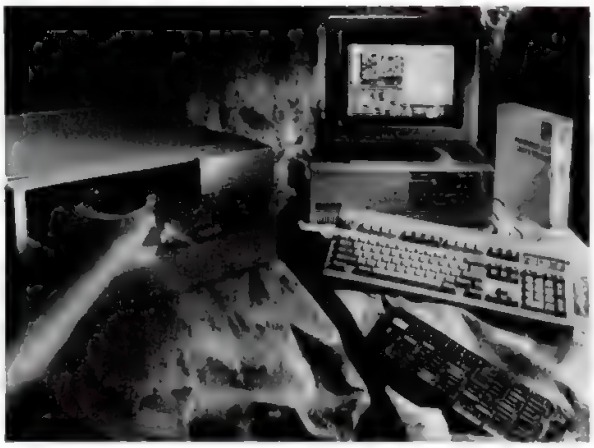

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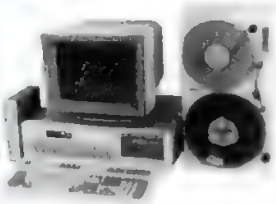

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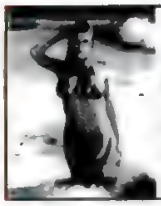

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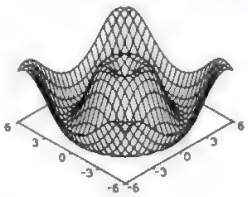

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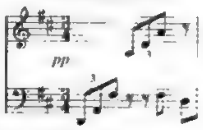
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Source: Beta Research Study, 1988

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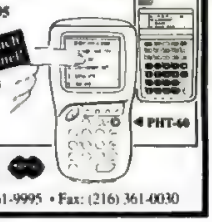

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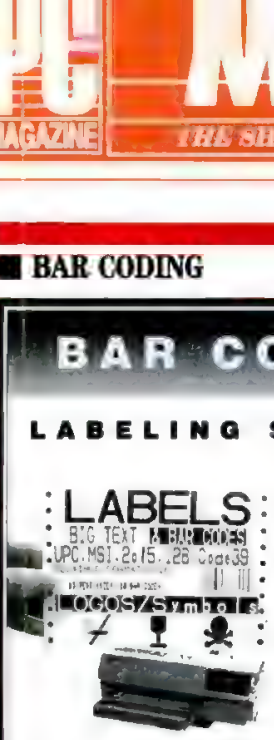

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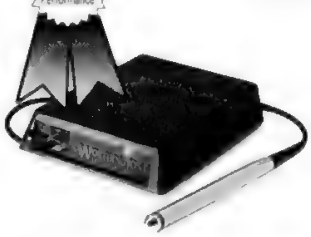

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Source: Beta Research Study, 1988
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COMING UP

■ TECHNICAL EXCELLENCE

"The envelope, please. . . ." *PC Magazine*'s 1990 Technical Excellence Awards honor the impact-making industry products—the ones that advance the state of the art and improve the life of the user—as well as the people behind them. Winners and finalists represent the industry's most innovative offerings in the last year.

■ THE BEST OF 1990

PC Magazine editors pick the best products from the past year's bunch, the ones that captured our attention, earned our respect, and went far toward proving that the truly valuable product is the one you use the most.

■ ABORT, RETRY, FAIL? SPECIAL EDITION

Bill Howard's look at the bizarre side of the PC industry in 1990.

■ AUTO MENUING SYSTEMS

You may not need a program that hides the DOS prompt and generates a menu from which to choose your applications, but you can probably think of a novice PC user who does. Contributing Editor Bruce Brown tests 9 menuing systems that put every application within easy reach and log how much time is spent on each one. Also included: how to write your own menus with batch programs.

■ STILL MORE 386/33s

Thought you only had 45 33-MHz 386s to choose from? In this issue, *PC Magazine* reviews machines from vendors who offer updated versions of these heavy-duty workhorses. PC Labs tests 25 more 386/33s.

■ SPECIAL FUNCTION SERVERS

Do you have to walk too far and use separate servers to reach network printers? New devices marketed by Intel, Microtest, HP, and Castelle let you place printers and shared modems in convenient locations without wasting a PC. These products, some the size of a VCR tape, install quickly and work well. ■

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After Hours

Products for the Leisure Side of Personal Computing

Seasonal Picks: The Best Of After Hours

GAMES
by Jonathan Matzkin and Nathaniel Zelnick

Year-end, holiday shopping is a way of life for most people. Whether you're shopping for traditional gifts or for personal reward, more recreational software is purchased during the holiday season than at any other time. To help make holiday buying less of a gamble, we've put together a selection of our favorites. Some are for pure entertainment. Others are for more-thoughtful pursuits, such as tracing your ancestry or helping kids learn as they play.

In the coming weeks you may drink too much, and you may eat too much. But we don't think you'll go wrong with any of these products as gifts—whether for your friends, your children, or yourself.

IF I WERE IN CHARGE . . .

Perhaps the most talked-about PC game in recent memory is *Sim City* ($49.95) from Broderbund Software. This complex, challenging simulation is a must for anyone who has ever sworn that he or she could run things better than the mayor. In fact, before you can run things, you have to *build* them.

You have a limited budget, of course (though you can raise taxes), and you have to provide all of the physical plants and services that make a city run. Matters are complicated by the simulated citizens of your metropolis, who whine about taxes and demand everything from sports stadiums to increased police protection. Addicting is too mild a word for *Sim City*; for some players, it becomes an obsession. That obsession could take a turn for the worse with the introduction of a sequel, *Sim Earth*, which should be in the stores in time for the holiday season.

If governing a city seems like too trivial a task, consider Accolade's *Balance of the Planet* ($49.95), which offers a chance to manage—and clean up—the world's environment. Created by Chris Crawford, who is best known for his earlier *Balance of Power*, *Balance of the Planet* offers considerable insight into the daunting problems that arise when economy and ecology conflict.

For that special someone who likes to make the really *big* decisions, consider a game called *Populous* ($49.95) from Electronic Arts. Surely one of the most conceptually weird games of all time, *Populous* pits one deity (you) against another (the PC). The idea is to destroy the opposing deity's followers, and then the deity himself.

Broderbund Software, San Rafael, Calif., (800) 521-6263.

CIRCLE 636 ON READER SERVICE CARD

Accolade, San Jose, Calif., (408) 296-8400.

CIRCLE 637 ON READER SERVICE CARD

Electronic Arts, San Mateo, Calif., (800) 245-4525.

CIRCLE 638 ON READER SERVICE CARD

THE SPORTING LIFE

The sports nut in your life will undoubtedly appreciate a copy of *Wayne Gretzky Hockey* ($54.95) from Bethesda Softworks. *Gretzky* has settings that accommodate all levels of "athletic ability." Beginners can control a player and leave coaching decisions to the computer; more-advanced students of the game can control both the action on the ice and the decision making on the bench. There is even a mode that controls all aspects of play for both teams; you just sit back and watch.

Accolade's *Jack Nicklaus' Unlimited Golf & Course Design* ($59.95), which was designed with considerable input from the Golden Bear himself, takes PC golf simulation to new heights. Any avid golfer will appreciate the realistic 256-color, 320-by-200 graphics and the natural feel of play. But best of all, the lucky recipient of *Unlimited Golf* can actually design and build courses, starting from an undeveloped tract of land. The manual serves as an introduction to the fundamentals of course design.

Bethesda Softworks, Rockville, Md., (800) 677-0700.

CIRCLE 639 ON READER SERVICE CARD

Accolade, San Jose, Calif., (408) 296-8400.

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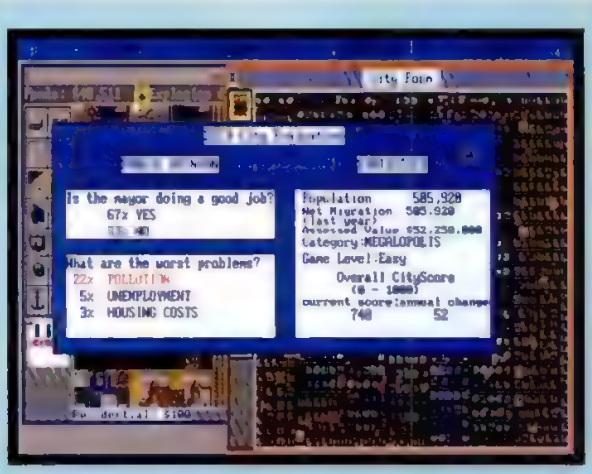
WISH LIST

In this special After Hours, we offer a selection of our favorite software as gift suggestions. Choose from among games, simulations, and educational titles. Or perhaps a subscription to an on-line service, or a genealogy program with which to explore your roots.



Sim City introduces gamers to the welter of problems, issues, and details that the mayor of a modern city must cope with.

FLYING FIGHTING MACHINES

Military aircraft simulation remains one of the most popular genres among PC gamers of all ages. *LHX Attack Chopper* from Electronic Arts ($94.95) gives would-be helicopter pilots a glimpse of what it's like to fly some of the most advanced aircraft ever conceived. Flying the thing is hardly your only concern, though, since you must also cope with a barrage of enemy fire, both from other aircraft and from the ground.

For armchair top guns, *F-19 Stealth Fighter* ($69.95) from Microprose could prove to be

CONTINUES

Holiday Gift Guide

CONTINUED

an irresistible diversion. The software puts you in the cockpit of a futuristic jet that slips undetected through enemy defenses.

Fans of military history can relive *The Battle of Britain* through an excellent simulation ($59.95) from Lucasfilm Games. Unlike some war games, this simulation spares few of the gory details of war.

Electronic Arts, San Mateo, Calif., (800) 245-4525.

CIRCLE 638 ON READER SERVICE CARD

Microprose Simulation Software, Hunt Valley, Md., (301) 771-1151.

CIRCLE 640 ON READER SERVICE CARD

Lucasfilm Games, San Rafael, Calif., (800) 782-7927.

CIRCLE 641 ON READER SERVICE CARD

CIVIL AVIATION

Many PC aviators love to fly but would just as soon skip the weaponry and attendant bloodshed found in military simulations. For peace-loving flyers, *Flight Simulator* from Microsoft remains the acknowledged classic. Version 4.0 ($54.95) has enhanced ground detail, a larger choice of planes, and even a facility for designing and testing new aircraft. It also supports multiple players via modem.

Many aviation buffs wonder what it's like in the high-pressure environment of the control tower. The curious can get an ample dose of white-knuckle working conditions from Wesson International's *Tracon II* ($69.95), which faithfully recreates the controller's radar screen. The simulation can be linked via modem to *Flight Simulator* 4.0 so that the *Flight Simulator*-generated plane appears on the *Tracon* screen, and other planes from the *Tracon* screen can be made visible on the screen running *Flight Simulator*. Verbal responses from pilots are barked at you via digitized speech.

Microsoft Corp., Redmond, Wash., (206) 882-8080.

CIRCLE 642 ON READER SERVICE CARD

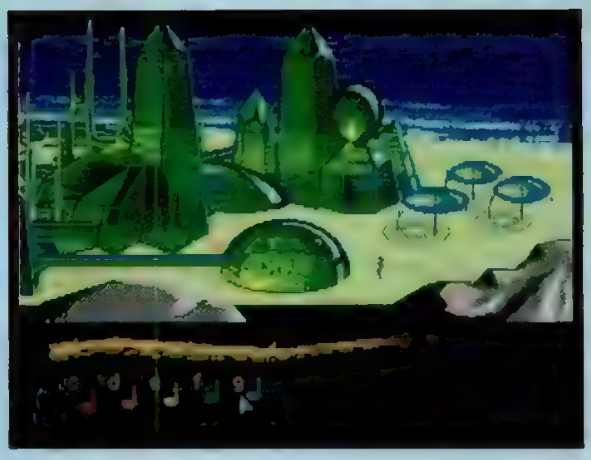
Wesson International, Austin, Tex., (512) 328-0100.

CIRCLE 643 ON READER SERVICE CARD

FOR THE ADVENTUROUS

As PC graphics have improved, supporting higher resolutions and more simultaneous colors, graphic adventure games have gotten steadily more sophisticated. Sierra Online, the company responsible for pioneering the genre, offers *Leisure Suit Larry III* ($59.95), the latest installment in what is undoubtedly the most famous adventure series of all. The first two installments in the series remain available.

Lucasfilm Games recently broke new ground in graphic adventure games with its aesthetic *Loom* ($59.95). This animated fairy tale requires no text input from the player. Commands are issued by pointing with a mouse and by playing melodies on a musical staff that is part of *Loom*'s innovative interface. Hardcore gamers won't find much challenge in *Loom*, but playing the game is a wonderfully relaxing, completely engrossing experience.



Lucasfilm Games' *Loom* makes novel use of a musical staff in its very innovative, mouse-based user interface.

Access Software's *Mean Streets* ($59.95) will really show off your VGA system's graphics capability. Many of the game's screens are rendered in near-photographic quality 256-color MCGA mode, and the plot, though set in the future, is heavily reminiscent of a 1940s film-noir movie.

Sierra Online, Coarsegold, Calif., (800) 326-6654.

CIRCLE 644 ON READER SERVICE CARD

Lucasfilm Games, San Rafael, Calif., (800) 782-7927.

CIRCLE 641 ON READER SERVICE CARD

Access Software, Bountiful, Utah, (800) 800-4880.

CIRCLE 645 ON READER SERVICE CARD

NO QUARTERS REQUIRED

Arcade-style games are a terrific source of relaxation, because most of them can be enjoyed either at length or for just a few quick minutes in the middle of a busy day. The PC has become the premier platform for arcade games, and at least one title, Spectrum HoloByte's classic *Tetris*, crossed over to the quarter-gobbling machines after first appearing on the PC. Spectrum HoloByte's latest *Tetris* sequel, *Faces* ($39.95), adds an amusing new twist to the same basic idea. The falling blocks have parts of human faces on them, and the object is to line up the blocks to form recognizable mugs.

Far and away the best *Tetris*-style game yet developed, *Blockout* ($39.95), from California Dreams, keeps players riveted to their screens. *Blockout* expands *Tetris* into three dizzying dimensions. Three-dimensional geometric shapes fall into a well; the idea is to completely cover the floor of the well. The shapes of the blocks are configurable, and the blocks can be rotated on their x, y, or z axes.

Spectrum HoloByte, Alameda, Calif., (415) 522-1164.

CIRCLE 646 ON READER SERVICE CARD

California Dreams, San Jose, Calif., (408) 378-0340.

CIRCLE 647 ON READER SERVICE CARD

AN ELECTRONIC PLAYROOM

Kids who grow up with PCs in their home take to them like fish to water. And PC-literate tots are way ahead of their Nintendo-playing friends, because the PC educates as well as entertains. The educational software programs on our holiday wish list make electronic learning a pleasant, natural process. Each program effectively blends the excellent graphics, action, and fun of the best games with educational content that children absorb at their own rate.

Broderbund Software's *The Playroom* ($44.95) teaches basic prereading and counting skills

CONTINUES

Jack Nicklaus' Unlimited Golf & Course Design lets would-be course architects place hazards wherever they choose.

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At PC Globe, Inc. we thrive on making things simple. It's the concept that's allowed us to combine traditional maps and geography with world facts and statistics.

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What's more, PC Globe software supports popular programs for creating graphics and preparing text.

PC USA 2.0, DISCOVER AMERICA

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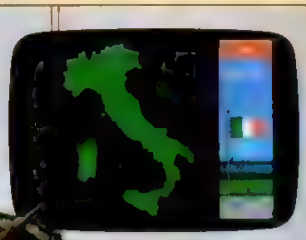
What we've done here is provide a new set of tools for living in a global world. Affordable programs that allow more time for understanding – and a better understanding of our times.

"PC GLOBE AND PC USA ARE SUPERB PROGRAMS THAT MAKE GEOGRAPHY COME ALIVE." *Barry Simon, PC Magazine*



PC GLOBE, A WORLD OF MAPS AND UTILITIES

- World, continent and country maps showing city locations
- Country maps outlining elevations, lakes, rivers, mountains and features
- Political alignment maps such as NATO, OPEC, etc.
- Automatic currency conversion and exchange rates
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- Point-to-point distances and bearings
- All information updated annually

A WORLD OF COMPARISONS

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- GNP, import/export and commodities
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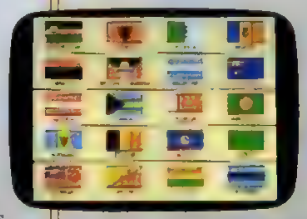
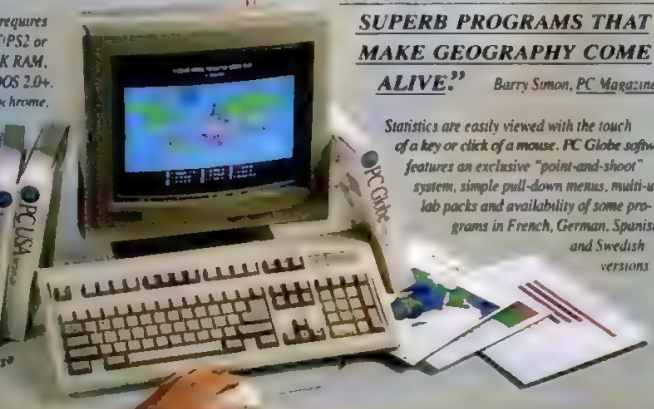
- Data and maps are easily exported to PC Paintbrush®, WordPerfect®, PageMaker® and Lotus 1-2-3®.



System requires IBM® PC/XT/AT/PS2 or compatibles with min. 512K RAM, floppy drive or hard disk. DOS 2.0+. Supports Hercules® monochrome, CGA, EGA, or VGA displays. PC Globe, Inc. makes other geography software products for business, travel entertainment and learning. Selected titles are available for use with the Macintosh® and Apple IIgs® personal computers.



Statistics are easily viewed with the touch of a key or click of a mouse. PC Globe software features an exclusive "point-and-shoot" system, simple pull-down menus, multi-use lab packs and availability of some programs in French, German, Spanish and Swedish versions

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TaxCut is the ONLY Expert System for Managing Your Taxes™

TaxCut's "Expert System" puts an expert at your side. Unlike any other tax preparation program, TaxCut uses artificial intelligence to let you interact with tax lawyer Daniel Caine and his team of experts while you prepare your return. Their professional experience is available with a keystroke as you fill in forms and schedules on screen. Or let them guide you step-by-step through an interview designed to find the best tax strategy for your unique situation. Work the way you're most comfortable and at your own pace.

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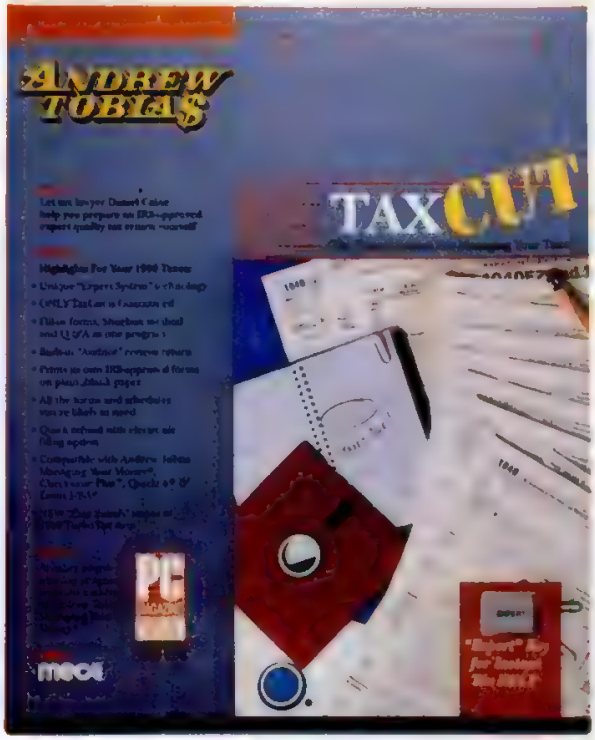
Harvard tax lawyer Dan Caine puts it most simply. *"I designed a tax package that works with you the way I would."*



Rated #1 by BusinessWeek and Money Magazine
"Suitable for people who don't know a C-prompt from a sea biscuit. TaxCut takes nothing for granted. Its Shoebox feature intelligently assumes that many of us simply hand an accountant a boxful of receipts." - Money Magazine

New York Times - *"TaxCut (is) our choice..."*

PC Magazine "Editor's Choice" 2/2/90

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Holiday Gift Guide

CONTINUED

in an entertaining context that minimizes the potential for frustration. *The Playroom*'s main screen consists of a colorful graphic of a child's playroom. An ultra-simple mouse-based interface lets your child explore the room in much the same way that a preschooler would examine the real world: by looking and pointing. Clicking the mouse cursor on an interesting object initiates an animated sequence or activity designed to stimulate and educate.

Clicking on the fish bowl, for example, causes the fish to blow bubbles. Clicking on the baby dinosaur wakes it up, and clicking on the bird cage elicits a song from its occupant.

Six of the room's objects trigger more-elaborate activities. The computer, for example, starts a simple letter and word recognition game that teaches both upper- and lowercase letters and pronounces each word and letter phonetically. The cuckoo clock can be set to any time and shows a picture of a cute character named Pepper Mouse engaged in an activity appropriate to that time of day. A "Mixed-Up Toy" game lets your kid build funny fantasy beings out of different heads, bodies, and legs.

The Playroom offers hours of developmental fun. The rewards for exploring its contents are so great that your children won't want to leave. But when they've outgrown this room you can upgrade them to the fast-paced educational action of The Learning Co.'s *Super Solvers OutNumbered!* ($49.95).

Broderbund Software, San Rafael, Calif., (800) 521-6263.

CIRCLE 636 ON READER SERVICE CARD

HAVE FUN, LEARN MATH

OutNumbered! combines action and adventure with nearly painless math instruction. The object is to foil the evil Morty Mischief as he tries to take over the Shady Glen TV station. To do so, your kids unravel the math clues hidden behind equipment in each room in the station.

The graphics and animation in *OutNumbered!* are absolutely first-rate and will immediately attract many children in the same way that less-educational games do. Throughout *OutNumbered!*, successful completion of math problems is rewarded with clues as to the whereabouts of the dastardly Morty.

Davidson & Associates, another educational software company, is justifiably famous for its *Math Blaster* series. *New Math Blaster Plus* ($49.95) takes a slightly different tack from *OutNumbered!*, in that it offers a series of arcade-like games instead of a single integrated plot. Intended for ages 6 to 12, the software teaches and reinforces a variety of math concepts, including the four basic operations, decimals, and problem solving.

The Learning Co., Fremont, Calif., (800) 852-2255.

CIRCLE 648 ON READER SERVICE CARD

Davidson & Associates Inc., Torrance, Calif., (800) 545-7677.

CIRCLE 649 ON READER SERVICE CARD

WHERE IS CARMEN, ANYWAY?

Probably the most popular of the action/learning programs for the PC is Broderbund's *Where in ... is Carmen Sandiego* series. The initial geography games, *Where in the World Is Carmen Sandiego* ($49.95) and *Where in the USA Is Carmen Sandiego* ($49.95) were smash hits in a variety of different hardware formats from the Sega system to the PC. The latest, *Where in Time is Carmen Sandiego* ($49.95), which teaches history, promises to have the same impact. Broderbund has recently released a deluxe VGA-only version of *Where in the World is Carmen Sandiego* ($79.95) that uses even more-sophisticated graphics and digitized sound.

Each game revolves around the Acme Detective Agency's perennial battle with Carmen Sandiego and V.I.L.E. (Villain's International League of Evil), her band of armed thieves. V.I.L.E. agents are clever, and tracking them down requires a thorough knowledge of history and geography, including world and state capitals, flags, and major exports.

The need for these facts forces players to use reference materials. Each package comes with reference books to help players catch the thief. *Where in the USA* . . . includes Fodor's *USA Travel Guide* to help unravel the elusive clues. The *1987 World Atlas* comes with *Where in the World* . . . , and *Where in Time* . . . includes the *New American Desk Encyclopedia*. There are thousands of permutations and hundreds of clues in each game. With each adventure, your children absorb more knowledge of the world around them and its history. More important, they learn the research skills that can separate a struggling student from a successful pupil.

Broderbund Software, San Rafael, Calif., (800) 521-6263.

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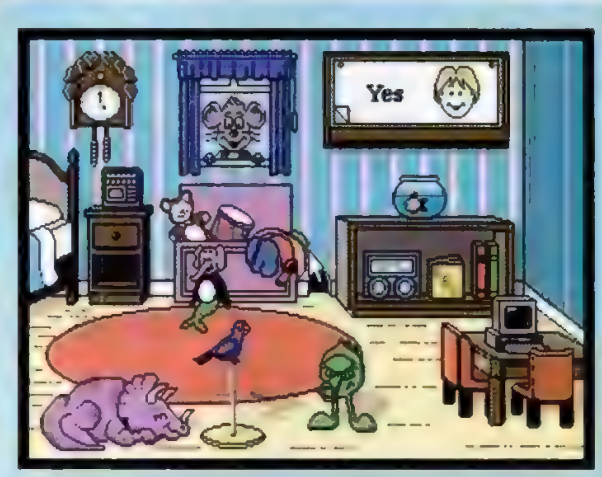

Broderbund's *The Playroom* packs a world of surprises and learning behind a simple-looking graphic of a child's room.

AROUND THE WORLD WITH A MOUSE

Of course, the PC can do much more than teach students how to use traditional paper-based research materials. Increasingly, reference books themselves are making the jump to electronic storage. The advent of CD-ROM as a relatively affordable mass storage medium—with multimedia capabilities—has only sped up the process.

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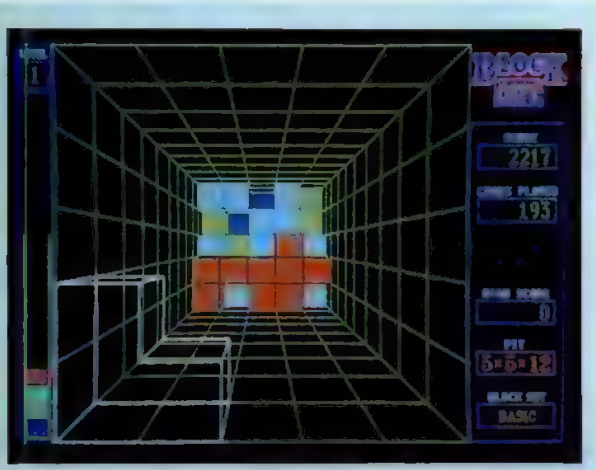

***Blockout* could very well be the ultimate extension of the *Tetris* metaphor. Game play takes place in three dimensions.**

After Hours

Holiday Gift Guide

CONTINUED

The PC's steadily improving graphics capabilities make it a terrific platform for a whole new generation of atlases. PC Globe Inc.'s *PC Globe* ($69.95), which is distributed on floppy disks, puts the world at your fingertips; it makes a terrific gift for students and those with terminal wanderlust. Detailed maps of 177 countries can be accessed through pull-down menus or by simply clicking on the desired region. Additional menus give you volumes of data about the various countries, including everything from population and GNP to currency conversion rates.

Currently, *PC Globe* tops the field of PC-based atlases, although several are certainly worthy in different ways. The Software Toolworks' *World Atlas* ($59.95) has a snazzier interface, more maps (240), and allows you to zoom in on regions and then to countries from the world map. It doesn't have the cross-indexing abilities of *PC Globe*, nor does it have the sheer volume of text data, but as a graphical reference, *World Atlas*'s images are impressive. Topographical maps show you the general terrain of any country, and the world map has a quick breakdown of major comparative features such as color-coded graphs of GNP ratios and literacy rates.

PC Globe Inc., Tempe, Ariz., (800) 255-2789.

CIRCLE 650 ON READER SERVICE CARD

The Software Toolworks, Los Angeles, Calif., (415) 883-3000.

CIRCLE 651 ON READER SERVICE CARD

LOOK IT UP ON-LINE

If you want more than just the world, zoom into the atlas function of *Compton's MultiMedia Encyclopedia* ($895) and go from there. Imagine an entire multivolume encyclopedia with 63,500 entries (31,200 full articles), 15,000 photographs and images, and 65,000 dictionary entries combined with 500 tables. Now add animation and sound and squash it all onto one CD-ROM, and you have Encyclopaedia Britannica Educational Corp.'s vision of encyclopedias' future. Offering an interactive graphical interface and hypertext search features, *Compton's* is an electronic reference tour de force. In addition to a CD-ROM drive, *Compton's* requires VGA graphics and a mouse.

Encyclopaedia Britannica Educational Corp., Chicago, Ill., (800) 323-1229.

CIRCLE 652 ON READER SERVICE CARD

CHAPTER AND VERSE ON DISK

Even the Holy Bible has found its way onto the personal computer. There are many fine software packages that offer help to those who turn to the Good Book for insight, solace, or research. Two outstanding examples, which make appropriate holiday gifts in our electronic age, are *Compubible* ($99) from NASSCO Inc. and *PC Study Bible* ($149.95) from BibleSoft. *Compubible* has a very well-thought-out interface that allows up to four simultaneous windows for comparisons of different Bible versions. The software comes with your choice of translation (additional Bible versions are $79 each). Windows can also compare different books and verses within the same Bible version. *PC Study Bible* also does windows, but its greatest strength is its inclusion of four complete Bible versions (The King James, The New International, The American Standard, and Nave's Topical Bible) for its initial purchase price.

NASSCO Inc., Lubbock, Tex., (800) 288-2044.

CIRCLE 653 ON READER SERVICE CARD

BibleSoft, South Seattle, Wash., (206) 824-0547.

CIRCLE 654 ON READER SERVICE CARD

KEEPING TRACK OF THE FAMILY

The holidays naturally stimulate thoughts of home and family; genealogy software can help bring families together, both on paper and in reality. Numerous programs are available for everyone from the casual user in search of his roots to professional genealogists who pursue the most obscure family connections. *Family Tree Maker* ($59.95) from Banner Blue does exactly what its name suggests. Input is simple and logical, and the program prints presentation-quality family trees on parchment-like paper that is included free.

One of the best-known and best-supported genealogy packages is *Personal Ancestral File*, which is published by the Family History Department of The Church of Jesus Christ of the Latter Day Saints, also known as the Mormon Church. The program is not sold in stores and is available only from the Family History Department, which accepts phone orders. At $35, *PAF* is one of the best software bargains to be had anywhere.

Banner Blue, Fremont, Calif., (415) 794-6850.

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Family History Department, Church of Jesus Christ of the Latter Day Saints, Salt Lake City, Utah, (801) 240-2584.

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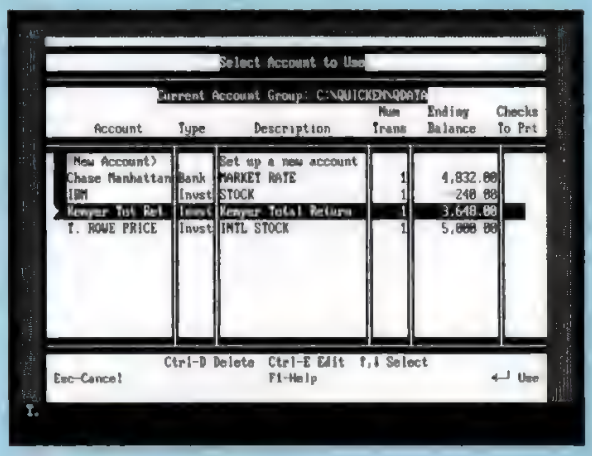

***Quicken*'s latest additions include a portfolio manager, which tracks trades and changes in share value.**

BUILDING YOUR FORTUNE

Financial management software isn't everyone's idea of a Christmas morning surprise. But if there are people in your life who always talk about getting organized, there are several clear choices for helping them help themselves.

Quicken 4.0 ($59.95) from Intuit Software has been widely popular for handling the most basic budgetary job: paying bills. It's incredibly simple to learn, and because it gives you an "as you like it" approach to assigning payment categories, you can do a little or a lot of financial analysis with it. This year, *Quicken* added a portfolio manager that's just as easy to learn.

For loved ones with a more meticulous approach, *Andrew Tobias's Managing Your Money* 7.0 ($219.98) will seem like the trusted advisor they never had. Every common financial avenue is charted and tracked. Meca Software's *MYM* encourages good habits by explaining the pitfalls of certain investments, and provides tools like loan analysis and tax estimation.

MYM even suggests the amount of life insurance coverage you should have. If you looked at *MYM* in the past and were turned off by its clumsy structure, you'll be a lot more comfortable with this year's streamlined, pull-down menu design.

Planning for future financial security can seem like an impossible task, given the unpredictable economy and the high cost of housing, college education, and other components of the American dream. Instead of keeping books or writing checks, *WealthBuilder by Money Magazine* ($249.95) from Reality Technologies helps you organize your financial plans, set

CONTINUES

Holiday Gift Guide

CONTINUED

goals, and find ways of achieving them. By picking the perfect mix of stocks, bonds, cash, and mutual funds, the program helps protect your savings against inflation, stock market swings, and other economic hazards. *WealthBuilder* also seeks to balance your goals against your willingness to take risks.

Taxes are hardly a cheerful subject in the holiday spirit, but a gift of tax preparation software may elicit increasing gratitude as April 15 bears down on us all. Among the tax software our expert has examined, two programs clearly stand out. *TurboTax* ($75) from ChipSoft has long been acknowledged as the best in its class. From its logical command structure to its automatic recalculation feature, *TurboTax* smoothes and speeds the unpleasant process of preparing personal returns. ChipSoft has aggressively upgraded the program over the years, and next year's version should continue that tradition.

Andrew Tobias's TaxCut ($89.95) from Meca Software is also an excellent choice for personal tax preparation. Last year's version added tax lawyer Dan Caine's considerable technical expertise. Caine's *Ask Dan About Your Taxes* was folded into a new version of *TaxCut*; the result was a single, seamless package of exceptional depth and thoroughness.

PC Magazine will of course review the newest versions of both *TurboTax* and *TaxCut*, along with the latest and best from other tax software publishers, in time for the 1991 tax season.

Intuit Software, Menlo Park, Calif., (800) 624-8742.

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Meca Software, Westport, Conn., (203) 222-9150.

CIRCLE 658 ON READER SERVICE CARD

Reality Technologies Inc., Philadelphia, Pa., (800) 346-2024.

CIRCLE 660 ON READER SERVICE CARD

Version 7.0 of *Managing Your Money* sports a totally overhauled interface featuring pull-down menus.

ChipSoft Inc., San Diego, Calif., (619) 453-8722.

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CONNECTING TO THE WORLD

On-line services are finally starting to bring us the computerized household that futurists first described decades ago. Perhaps that's because the home computer seems, at long last, to have arrived. Maybe it's because 2,400-bit-per-second modems can easily be had for less than $100. But none of that hardware would have a window on the world without ventures like Prodigy, GEnie, and CompuServe.

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Plano, Tx 75074

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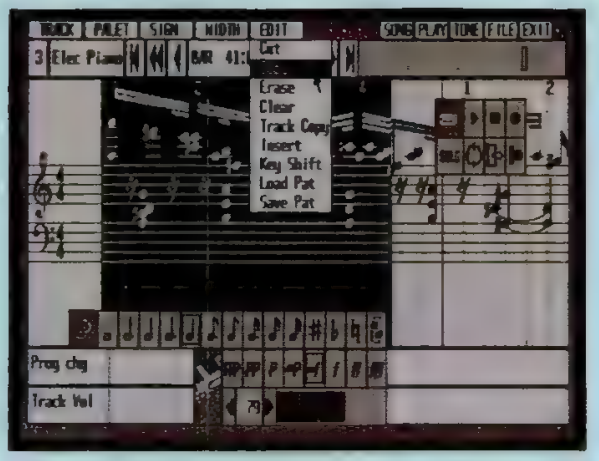
Holiday Gift Guide

CONTINUED

Prodigy, the much-publicized joint venture between IBM and Sears, offers a widening variety of entertainment and services for a flat rate of $12.95 per month (though the electronic mail service now carries a per-message charge if you exceed a monthly allotment). With its graphical interface and emphasis on ease of use, Prodigy aims squarely at users who may have little or no previous PC experience. There's an on-line version of the well-known *Carmen Sandiego* educational game, and users can also access an on-line encyclopedia. Brokerage services are available, as are a variety of retail outlets. Startup kits ($49.95) are available at software retail outlets.

The flat fee approach seems to be catching on. GEnie, which offers a very wide array of services to the on-line consumer, recently introduced a subset of those services, called GEnie Star*Services, for a very reasonable $4.95 per month. Many of the features seem designed to compete with Prodigy; there is electronic mail in addition to on-line games, shopping services, weather information, and news. Most intriguing, though, is the idea that Star*Services provides an inexpensive introduction to GEnie for the neophyte. If a user gets bored with the range of flat-rate options, the rest of GEnie lies beyond—albeit at higher cost.



Ballade **displays tracks of a sequence in traditional music notation. Editing is reminiscent of some paint programs.**

CompuServe remains the preeminent on-line service for power users and those seeking the widest imaginable array of features. CompuServe does not yet offer a flat-rate service, however, which makes it a bit problematic for family use on an unsupervised basis. With all it has to offer, CompuServe can easily keep a user on-line to the tune of some hefty usage charges. But for the serious PC junkie, a CompuServe subscription or a gift of connect time will make a much appreciated gift. CompuServe offers a $39.95 sign-up package that includes a usage credit and a front-end software package called *CompuServe Information Manager*, which uses a windowing metaphor to maximize ease of use.

Prodigy Services Co., White Plains, N.Y. (800) 776-3449.

CIRCLE 661 ON READER SERVICE CARD

The GEnie Service, Rockville, Md., (800) 638-9636.

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CompuServe Information Service, Columbus, Ohio, (800) 848-8199.

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MAKING BEAUTIFUL MUSIC

In the last few years, sophisticated electronic music technology has become widely available. Your personal computer can be the cornerstone of a relatively inexpensive music system that Wendy Carlos would have envied just a few years ago. MIDI, the musical instrument digital interface standard, allows the PC to communicate with and control any MIDI-compatible instrument.

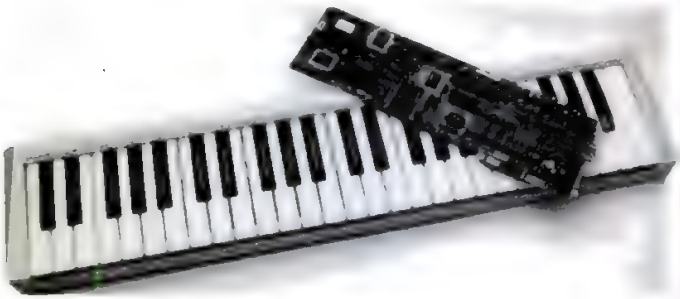
Sequencers are software programs that turn your PC into a sort of digital recording studio. The software records instructions or "sequences" that tell MIDI instruments what to do and when to do it. Among the many fine packages available is *Cakewalk* ($150) from Twelve Tone Systems, which won an Editor's Choice award from *PC Magazine* a couple of years ago. It's an excellent value for the money and offers considerable sequencing power. Twelve Tone recently introduced *Cakewalk Professional*, a more powerful, more expensive ($249) version that meets the needs of professional musicians.

Master Tracks Pro ($395) from Passport Designs was recently ported from the Macintosh environment (which remains very popular with musicians) to *Microsoft Windows*. It exploits the graphical environment beautifully and gives PC-based musicians much of the flexibility and power long taken for granted by their Mac siblings.

Music hobbyists looking for a sequencer that balances ease of use, power, and fun should take a hard look at Dynaware's *Ballade* ($195). Though it lacks some features that pros can't live without, *Ballade* has more than enough power to accommodate the musical imaginations of Depeche Mode wannabes. The latest version prints hard copy of musical notation, a boon to less-than-musically-literate composers.

Ballade works only with the Roland MT-32, LAPC-1, and CM32-L MIDI synthesizer modules. If you don't already own one of these great-sounding little boxes, consider Roland's IBM PC Computer Music System. For $995, this MIDI starter set gives you everything you need to get going with computer music, except the computer and musical talent. That includes a MIDI interface for your PC, a copy of *Ballade*, an LAPC-1 (which also sounds great as a sound source for a wide variety of PC games), and a keyboard controller.

You can assemble a similar system for considerably less money by buying less-expensive components separately, but everything included is first-rate, and everything is right there in the box. ■



Roland's all-in-one MIDI starter kit isn't cheap, but it contains everything you need to start sequencing.

Twelve Tone Systems Inc., Watertown, Mass., (800) 234-1171.

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Passport Designs, Half Moon Bay, Calif., (415) 726-0280.

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CIRCLE 327 ON READER SERVICE CARD

by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

rma, associate publisher, Lisa Kilcrease, publisher's assistant; Joseph Brocato, A. Clark, publisher, and Bob Dietsch, editor
leen Bober, who designed the cover for the first issue of the *Digest* in April 1986

"As you can readily see from our cover design this month, Computer Digest is five years old," proclaims **the publisher's column in the April 1990 issue, adding, "Digest readers —and there are more and more every month—are sophisticated. They can't be fooled; they want and deserve the best." Some readers might wonder, however, why a magazine that first published in April 1986 produces its fifth anniversary issue four years later.**

What Good Is a Fast Processor If You Don't Have a Fast Processor? (And Why You'll Get Slower Processing if You Don't)

"One quick caveat about megahertz. You may see ads bragging about how fast a particular machine is in terms of Mhz. Keep in mind that Mhz is only one factor in the overall performance equation. You can have a screamingly fast processor. However, if you do not have the processor to support it, you will encounter slower processing."
The Kansas City Star, May 20, 1990

Amazing Facts

"You can also transfer word processing documents [from the Atari Portfolio to a PC], but only in a data format called ASCII, which may be inconvenient for use with other word processors."
ConsumerReports, June 1990

"WAIT A MINUTE! THE MONSTER SEEMS CONFUSED, DISORIENTED. I THINK HE'S GONNA PASS OUT! GET THE NETS READY!!"

CARTOON: RICHARD TENNANT

Silicon Valley's Access computer store takes a liberal definition of free toner, according to this ad in *Bay Area Computer Currents*, April 10–23, 1990.

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of entry are considered. Winners this issue: Thomas V. Mukai (fifth anniversary issue), Michael J. Blazquez (free toner, $29), Andrew H. Lee (ASCII), Frank Baker (screamingly fast processor).

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☐ 286-based systems ☐ UNIX®-based systems
☐ 386-based systems ☐ Laptops
☐ 386SX-based systems ☐ Other: _____
☐ 486-based systems

2. Are you interested in computer products for:
☐ Home ☐ Business ☐ Resale

3. How many PCs does your company plan to purchase in the next twelve months?

Quantity	Timeframe	Quantity	Timeframe
_____	Less than 1 month	_____	6-12 months
_____	1-3 months	_____	More than 12 months
_____	3-6 months		

4. What do you plan to use computer products for?
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6. Are you interested in leasing? ☐ Yes ☐ No

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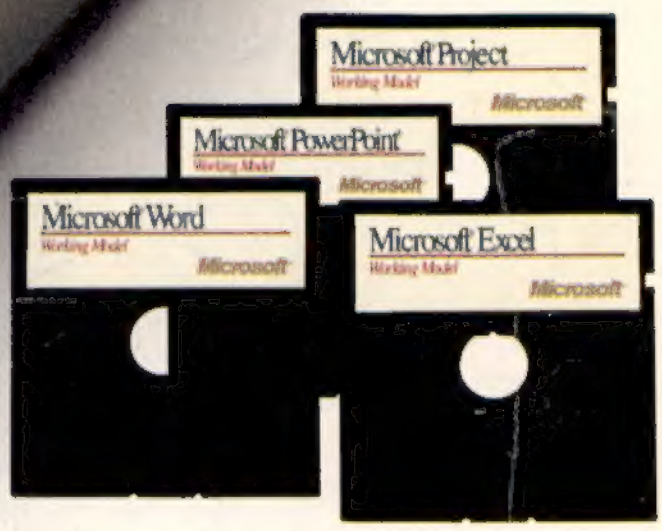

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